

Galliformes of India

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- * Promote national and international cooperation, and exchange of wildlife related information;
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Wildlife and Protected Areas

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Wildlife and Protected Areas

Galliformes of India

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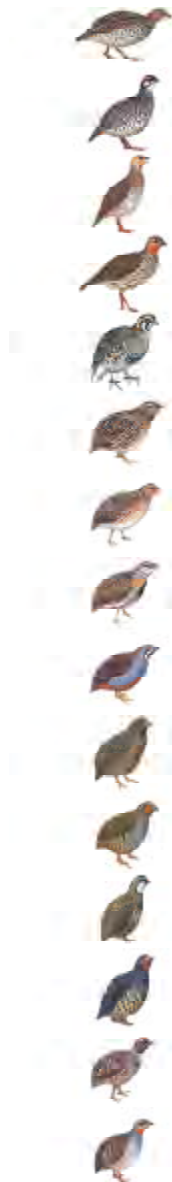


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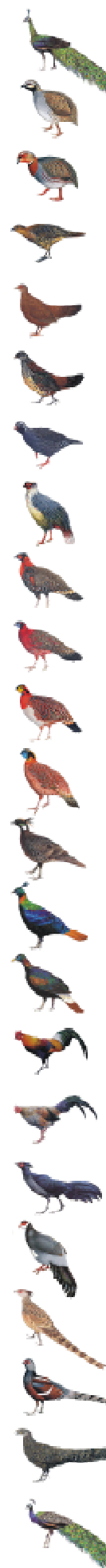
DIRECTOR'S NOTE

'Galliformes of India' is the first in the series of ENVIS Bulletin on Wildlife and Protected Areas that deals with Birds. The Order Galliformes is represented by a wide variety of pheasants, partridges, quails, francolins, snowcocks and megapode in India. Many galliformes species have been well recognized for their religious, socio-cultural and aesthetic values by people, all over India. A total of 45 species of galliformes have been recorded from India, of which seven are 'endemic' to India and the global status of 12 species is 'threatened', which includes the 'critically endangered' Himalayan Quail.

Through the Protected Area (PA) network of India, many populations of galliformes species and their habitats have been protected, but substantial populations of galliformes still occur outside the PA network. For instance, the distribution range of pheasants such as the Tibetan Eared Pheasant, Sclater's Monal, Green Peafowl, Grey Peacock Pheasant, Blyth's Tragopan and Temminck's Tragopan are not adequately covered under the PA network in the Himalayas and the same is the case for several other galliformes. Lack of basic information such as the status and distribution, and researched information on the population ecology, habitat use and behaviour has been a limitation in planning conservation of galliformes in India. During the last two decades, there have been surveys and studies on galliformes in India that have resulted in a better understanding of some of the species status and distribution, and in a few cases, have helped in planning appropriate in situ and ex situ conservation efforts. The Wildlife Institute of India (WII) has been contributing substantially in the field of galliformes research and training since 1989. These include the nation-wide surveys for the assessment of the status and distribution of the Indian Peafowl and the Red Junglefowl; surveys for pheasants in the western and eastern Himalayas; and the ecology and conservation of pheasants in the Himalaya, and the Nicobar Megapode. WII has also conducted training of field staff in monitoring of galliformes in the Himalaya, at the State and Division levels. Currently, WII has an ongoing research project on the conservation genetics of Red Junglefowl, the wild ancestor of all domestic chicken in the world.

This is the first ENVIS bulletin that has been peer reviewed - a step towards enhancing the quality of this series. I hope this issue will be of immense value to the biologists, wildlife managers and students interested in the conservation of galliformes in our country.

P.R. Sinha
Director, WII and Project Leader,
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FOREWORD

When I looked at the contents of this volume I felt very humble indeed. Humble because so many of the authors I know have had considerable educations leading to degrees, MScs and PhDs and I did not attend university. And humble because when I started WPA with a small group of friends more than 30 years ago, I could only have dreamt that it would lead to the research and interest in India's Galliformes that is so evident on every page. Working together in a common cause we have shown how much can be done with dedication and some careful planning.

It is clear that this publication could not have been written when WPA started. We simply did not have the knowledge in those days and the people who were trained and prepared to suffer hardships so that they could gather information on a Cheer pheasant or a Blyth's Tragopan were in very short supply, if not non-existent. Since then many highly dedicated young researchers have spent months toiling away in Himalayan forests, terai grasslands and in other often remote habitats finding out about these spectacular birds. Furthermore, at the start of the 1980s, the Government of India's ENVIS programme did not exist and nor did the Wildlife Institute of India! It is a great joy to me that all three of us have come together in this landmark publication that can be seen as really taking stock of how far we have come and what the future needs are.

Working in collaboration has been the key to so much of the progress that is described in these pages and the critical ingredient that gives me hope that we can address some of the big issues facing India's Galliformes. There is certainly much to do, but with the talent to meet these challenges increasingly available in India and the willingness of organisations such as WPA and WII to work together I have great hope that this volume will galvanise another big step towards long-lasting conservation.

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FOREWORD

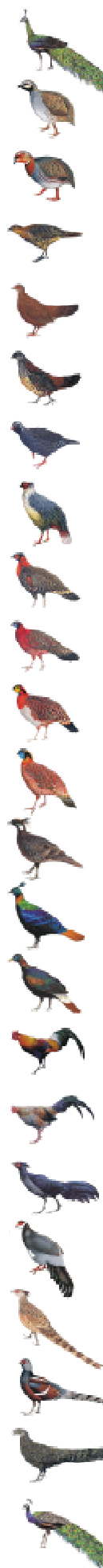
The birdlife in India is truly amazing. The total number of bird species in the world known so far are about 9,000, of which India accounts for around 1,250 species. This works out to about one-sixth of the world's avian diversity in a country that is less than 2% of the world's total land mass. The rich diversity of birdlife in India is exemplified by a group of birds that fall under the avian order Galliformes, which are often referred to as the 'game birds'. Of the 300 Galliformes species worldwide, 55 are found in south and central Asia and it is remarkable that India has 45 of these species. The Indian Galliformes fall under two main families: Phasianidae, which includes 44 species of Pheasants, Snowcocks, Spurfowls, Francolins, Partridges and Quails, and Megapodiidae, which is represented by a single species, the Nicobar Megapode.

Among the most attractive and spectacular birds of the world are the seventeen species of Indian Pheasants, which constitute one-third of the global total of 50 pheasant species. The glamorous Indian Peafowl is India's National Bird; it is also the State Bird of Orissa. In fact, several States have adopted different pheasant species as state birds. The lovely Monal Pheasant, "the bird of nine colours", is the state bird for Uttarakhand and also the national bird of Nepal. While Himachal Pradesh has the Western Tragopan as its State Bird, Nagaland has the Blyth's Tragopan, Sikkim has the Blood Pheasant, and both Manipur and Mizoram have the Hume's Pheasant as their state birds. This makes a total of seven Indian States having different pheasant species as their state birds. No other single group of birds can claim this high level of state recognition anywhere in the world.

Of all the world's birds, none has had a closer association with humans and contributed more to human health and welfare than the Red Junglefowl. From this one pheasant species, including its five sub-species, all the domesticated forms have originated and today this is probably the most widely distributed bird on earth. However, in the wild state within the country, the Red Junglefowl is found only in northern, eastern and some parts of central India. Elsewhere, i.e., in the south and the west and the lower parts of the central region, its close cousin - the Grey Junglefowl - holds sway.

The Indian Peafowl and the Red and Grey Junglefowls mentioned above are essentially birds of the plains. So also the Green Peafowl found in some parts of the north-east. All the other pheasants in India are to be found at high altitudes and can be called Mountain Pheasants. In terms of variety and numbers, north-east India is very rich and Arunachal Pradesh, with a tally of eleven out of seventeen species found in India, is exceptional. This works out to about 65% of India's pheasant species and a little more than 20% of the world's total.

While such remarkable diversity is laudable, the status of several pheasant species in the country is certainly a matter of concern. According to experts, at least six pheasant species are in the 'vulnerable' category, i.e., the Cheer Pheasant, Western Tragopan, Blyth's Tragopan, Sclater's Monal, Hume's Pheasant and Green Peafowl. Most of the others are also facing serious challenges, especially on account of





habitat loss and degradation in recent years and also because they have restricted or fragmented ranges. Scientific status surveys for these species deserve top priority.



The other galliformes species found in India total 27 consisting of Snowcocks (2), Francolins (5), Partridges (8), Spur-fowls (2), Quails (including Bush Quails) (9) and the Nicobar Megapode (1). These include the Himalayan Quail which has not been sighted in recent years and is considered 'Critically Endangered', and the Manipur Bush Quail which was sighted very recently in Assam after 74 years and is categorised as 'Vulnerable'. The other threatened species in this group are the Swamp Francolin, Chestnut-breasted Hill Partridge,, White-cheeked Hill Partridge, and the rather unique Nicobar Megapode.



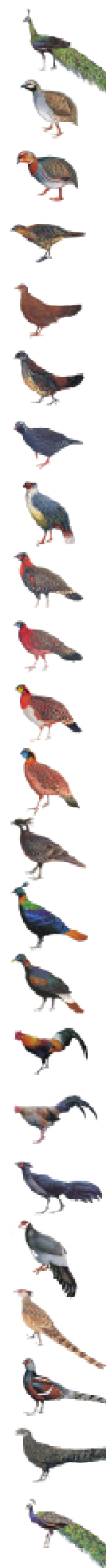
All these birds, like the pheasants, are essentially ground dwelling and hence the preservation of their habitats is crucial for their survival. In fact, the Galliformes are important indicator species and their presence or absence in an area is a good indication of the health of the ecosystem as such. The destruction of forests and grasslands in recent times all over the country has caused extensive loss of habitat for all these species. In the case of the Nicobar Megapode, the damage to its typical coastal habitat by the recent Tsunami has been very unfortunate. As for most wildlife, the single most serious threat to the survival of Galliformes is habitat loss, degradation or fragmentation. The other major threats are human disturbance, killing or trapping for local consumption and the use of pesticides and other chemicals in agriculture.

The movement for the conservation of pheasants and other galliformes in India is quite recent. Here, it is noteworthy that though the western countries cannot boast of any indigenous pheasant species, it is in Europe and USA that the captive breeding and aviculture of pheasants has been taken up in a big way and several aviaries have been established, where millions of pheasants are being raised from year to year. The underlying motivation is sport and hunting, which is really responsible for giving to these beautiful birds the rather unfortunate appellation of 'the game birds'. The first serious attempt to orient such activity towards conservation was made when the Pheasant Trust was formed in the UK in the late 50s. This paved the way for the establishment of the World Pheasant Association (WPA) in the mid-70s. Thereafter, the WPA helped establish regional chapters and the one in India, called the WPA-India, was set up in 1979. Since then, in collaboration with the WPA International, the above-mentioned national body has been striving to promote the cause of pheasants and other galliformes in the country.

WPA-India aims at creating awareness in the country about the ecological, economic and aesthetic importance of Galliformes, in general, and Pheasants, in particular, and works to arouse interest and support for the conservation of these birds from all sources, including government and non-government bodies and individuals. To this end, WPA-India also carries out and encourages studies and research on individual species in their natural habitats. However, in all such work, the real challenge lies in being able to generate public awareness and to mobilise the widest possible help and support, including that of all the concerned government agencies.

One major plank in the working of WPA-India is networking and partnerships with like-minded agencies and organisations. As a result, collaborative relationships have been forged with the Wildlife Institute of India, Central Zoo Authority, National Zoological Park, Bombay Natural History Society, Centre for Environment Education, Aligarh Muslim University and others. In April 2004, the Third International Galliformes Symposium was held in India and the venue was the Wildlife Institute of India (WII) at Dehradun. An important output of this highly successful event was the unanimous adoption of the South Asia Strategy for the conservation of Galliformes in the region. Subsequently, a Memorandum of Understanding was signed between the WII and WPA-India aimed at undertaking and facilitating research, training and educational activities for promoting the conservation of Galliformes. Following all this, the initiative of the WII to bring out this special issue on the Indian Galliformes is indeed significant.

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THE GALLIFORMES OF INDIA : AN INTRODUCTION

Galliformes, commonly referred to as 'gallinaceous birds' or 'game birds', is a large and diverse group of birds in the world that comprises of 70 genera and 284 species (Keane et al. 2005). Howard and Moore's Complete Checklist of the Birds of the World (2003) lists Megapodiidae (scrub fowl, brush-turkeys, mallee fowl), Cracidae (guans, chachalacas, curassows), Numididae (Guineafowl), Odontophoridae (New World quails) and Phasianidae (grouse, turkeys, pheasants and partridges) under the Order Galliformes. These birds are well recognized for their ecological, socio-cultural, aesthetic and economic values, and have become an integral part of the people and their culture. In this chapter, we give a brief overview of the Galliformes of India.

In India, 45 species of Galliformes have been reported which includes, one megapode, 27 partridges, quails, francolins and snowcocks, and 17 pheasants (Table 1). Of these, seven species are endemic to India, and the global status of 12 species is categorised as 'threatened'. This is largely due to habitat loss, habitat degradation and poaching.

The megapodes are a unique group of birds as they utilise external sources of heat to incubate their eggs (Jones et al. 1995). The family Megapodiidae consists of 22 species in seven genera, most of which are island forms are mainly found in the Indo-Australian region east of Wallace's line (Jones et al. 1995). In India, the Nicobar megapode *Megapodius nicobariensis*, occurs in the Nicobar group of islands (Abdulali, 1967; Ali and Ripley, 1983; Grimmet et al., 1998; Dekker 1992; Sivakumar 2000). More than 70% of the Nicobar megapode population declined due to tsunami that hit Asia in 2004 (Sivakumar, 2007).

India has a rich diversity of Partridges, Quails, Francolins, and Snowcocks that have centers of distribution in either eastern Asia, or western Asia and Africa, which is a consequence of the unique location of India at the crossroads of Asia (John Carroll, in this issue). Of the 27 species found here the Common Quail *Coturnix coturnix* is migratory. Two genera contain the largest number of species in India, Arborophila, or the hill-partridges, and Francolinus, the francolins. The Himalayan Quail *Ophrysia superciliosa*, is presently assessed as 'Critically Endangered' (IUCN), which has not been officially reported since the 1890s, but unconfirmed reports of its sightings, have kept it from being declared 'officially extinct'.

The most charismatic and popular of galliformes are the pheasants, the Indian Peafowl *Pavo cristatus*, the National Bird of India, and many Himalayan Pheasants that are 'State Birds' illustrates this fact. Of the 17 pheasants in India, 16 species occur in the Himalaya, except for the endemic Grey Junglefowl *Gallus sonneratii* that is confined to the Peninsular India. The Red Junglefowl *Gallus gallus* being the wild ancestor of all the domestic chicken in the world, has received much attention being one of the most important birds to mankind. Of the 12 species that are listed as 'threatened' in India, five are pheasants.

The highest diversity of Galliformes is seen in the Himalayan Biogeographic Zones, while the Andaman & Nicobar islands have only two resident species (Blue-breasted Quail in Nicobars and the Nicobar megapode). Biogeographically, a large number of Galliformes genera that are found in India have Oriental in affinities, with some showing Indo-Chinese links and others Indo-Malayan origins (Jayapal et al. this issue). However, species exclusive to the Trans-Himalayas are distinctly Palearctic in nature. One genus (*Francolinus*) is of African origin. There are seven endemic and eight restricted-range species within Indian limits.

Though the Protected Area (PA) network of India affords protection to many galliformes species and their habitats, substantial populations still occur outside the PA network. Habitats and populations both inside and outside PAs are facing serious threats in the form

of habitat loss, habitat degradation and poaching. In this issue, we have attempted to compile available information on the status, distribution and conservation of galliformes of India.

The issue is divided into eight sections in order to cover various facets of galliformes conservation in India. Section I gives species accounts of the 45 species that are present in our country. The three chapters in this section gives brief account of the species in a 'field guide' format which we believe, should be useful for all user groups. Section II deals with species of global and national significance and this includes Indian Peafowl, Red Junglefowl, Tragopans and the Himalayan Quail. The galliformes distribution in the selected biogeographic zones and PA network of India is presented in Section III. The status reports and the management of galliformes in the Himalayan range states, northeast states and Andaman and Nicobar Islands are presented in Section IV. The papers and articles dealing with conservation issues and management has been presented in Section V. This includes management issues and actions dealing with habitat loss, habitat degradation, poaching and the role of local communities in conservation. Under Section VI, we have presented the techniques that deals with monitoring of galliformes, identification of galliformes species from feather and live-trapping of galliformes. The view of international community on the conservation of galliformes in India has been placed under Section VII. Selected bibliography on galliformes of India is presented as the last Section of this issue.

Despite our best efforts, there may be a few gaps which may be brought to our notice for updating this compilation. We hope this issue will be of immense value to the biologists, wildlife managers and students interested in the conservation of galliformes in our country.

We thank all the authors and reviewers for their contribution and inputs for this issue. We thank Shri. P.R. Sinha, Director & Project Leader and Dr. V. B. Mathur, Dean & Project Coordinator, WII ENVIS Centre for their guidance, encouragement, and support. We thank Shri Jyoti Prasad Nautiyal, Shri Muthu Veerappan and Shri Rajeev Thapa for their help in preparation of this issue.

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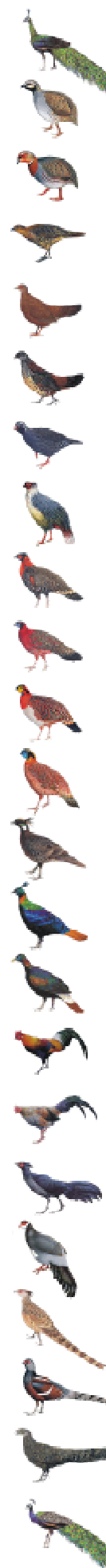




Table 1. Galliformes of India and their Conservation Status

	COMMON NAME	Scientific Name	POPULATION	IUCN	WPA Schedule
1	Nicobar Megapode	<i>Megapodius nicobariensis</i>	fairly common	vulnerable	I
2	Snow Partridge	<i>Lerwa lerwa</i>	fairly common	others	IV
3	Tibetan Snowcock	<i>Tetraogallus tibetanus</i>	uncommon	others	I
4	Himalayan Snowcock	<i>Tetraogallus himalayensis</i>	fairly common	others	IV
5	Buff-throated Partridge	<i>Tetraophasis szechenyii</i>	rare	others	IV
6	Chukar	<i>Alectoris chukar</i>	fairly common	others	IV
7	Black Francolin	<i>Francolinus francolinus</i>	common	others	IV
8	Painted Francolin	<i>Francolinus pictus</i>	fairly common	others	IV
9	Chinese Francolin	<i>Francolinus pintadeanus</i>	rare	others	IV
10	Grey Francolin	<i>Francolinus pondicerianus</i>	common	others	IV
11	Swamp Francolin	<i>Francolinus gularis</i>	fairly common	vulnerable	IV
12	Tibetan Partridge	<i>Perdix hodgsoniae</i>	fairly common	others	IV
13	Common Quail	<i>Coturnix coturnix</i>	fairly common	others	IV
14	Japanese Quail	<i>Coturnix japonica</i>	fair	others	IV
15	Rain Quail	<i>Coturnix coromandelica</i>	fairly common	others	IV
16	Blue-breasted Quail	<i>Coturnix chinensis</i>	uncommon	others	IV
17	Jungle Bush Quail	<i>Perdicula asiatica</i>	fairly common	others	IV
18	Rock Bush Quail	<i>Perdicula argoondah</i>	fairly common	others	IV
19	Painted Bush Quail	<i>Perdicula erythrorhyncha</i>	fairly common	others	IV
20	Manipur Bush Quail	<i>Perdicula manipurensis</i>	rare	vulnerable	IV
21	Hill Partridge	<i>Arborophila torqueola</i>	fairly common	others	IV
22	Rufous-throated Partridge	<i>Arborophila rufogularis</i>	fairly common	others	IV
23	White-cheeked Partridge	<i>Arborophila atrorularis</i>	fairly common	NT	IV
24	Chestnut-breasted Partridge	<i>Arborophila mandellii</i>	uncommon	vulnerable	IV
25	Mountain Bamboo Partridge	<i>Bambusicola fytchii</i>	uncommon	others	I
26	Red Spurfowl	<i>Gallus padana</i>	fairly common	others	IV
27	Painted Spurfowl	<i>Gallus sonneratii</i>	fairly common	others	IV
28	Himalayan Quail	<i>Ophrysia superciliosa</i>	Extinct?	CR	I
29	Blood Pheasant	<i>Ithaginis cruentus</i>	fairly common	others	I
30	Western Tragopan	<i>Tragopan melanocephalus</i>	rare	vulnerable	I
31	Satyr Tragopan	<i>Tragopan satyra</i>	rare	NT	I
32	Blyth's Tragopan	<i>Tragopan blythii</i>	rare	vulnerable	I
33	Temminck's Tragopan	<i>Tragopan temminckii</i>	rare	others	I
34	Koklass Pheasant	<i>Pucrasia macrolopha</i>	fairly common	others	IV
35	Himalayan Monal	<i>Lophophorus impejanus</i>	fairly common	others	I
36	Sclater's Monal	<i>Lophophorus sclateri</i>	rare	vulnerable	I
37	Red Junglefowl	<i>Gallus gallus</i>	common	others	IV
38	Grey Junglefowl	<i>Gallus sonneratii</i>	common	others	II
39	Kalij Pheasant	<i>Lophura leucomelanos</i>	common	others	I
40	Tibetan Eared Pheasant	<i>Crossoptilon harmani</i>	rare	NT	I
41	Cheer Pheasant	<i>Catreus wallichii</i>	uncommon	vulnerable	I
42	Mrs Hume's Pheasant	<i>Syrnaticus humiae</i>	rare	vulnerable	I
43	Grey Peacock Pheasant	<i>Polyplecton bicalcaratum</i>	fairly common	others	I
44	Indian Peafowl	<i>Pavo cristatus</i>	common	others	I
45	Green Peafowl	<i>Pavo muticus</i>	rare	Vulnerable	IV

CR = Critically Endangered

NT = Near Threatened



1.0 Megapode

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The megapodes are a unique group of birds as they utilise external sources of heat to incubate their eggs (Jones *et al.* 1995). The Megapodiidae, literally meaning big feet after the disproportionately large feet of the birds, were first described to science during Magellan's 1519-1522 expedition to the Far East (Frith 1956). The family Megapodiidae consists of 22 species in seven genera, most of which are island forms are mainly found in the Indo-Australian region east of Wallace's line (Jones *et al.* 1995). There are three exceptions to this: *Megapodius nicobariensis* from the Nicobar Islands, *Megapodius pritchardii* from Niuafo'ou Island and *Megapodius laperouse* from the Pulau and Marianna Islands. Thirteen of the 22 species are currently threatened by habitat destruction, introduction of predators, hunting and over-exploitation of eggs (Jones *et al.* 1995; Sivakumar 2007). In India, there is only one species, the Nicobar megapode *Megapodius nicobariensis*, which occur in the Nicobar group of islands (Abdulali, 1967; Ali and Ripley, 1983; Grimmet *et al.*, 1998; Dekker 1992; Sivakumar 2000). Species account of the Nicobar megapode is largely compiled from the following sources:

Abdulali, H. 1967. The birds of the Nicobar islands with notes on some Andaman birds. *J. Bombay Nat. Soc.* 64, 140-190.

Ali, S and Ripley, S.D. 1983. Handbook of the Birds of India and Pakistan. Compact Edition. Bombay Natural History Society, Oxford University Press, Delhi. 737pp.

Dekker, R.W.R.J. 1992. Status and breeding biology of the Nicobar Megapode *Megapodius nicobariensis abbotti* on Great Nicobar, India. Report, National Museum of Natural History, Leiden.

Frith, H.J. 1956. Breeding habits in the family Megapodiidae. *Ibis*, 98, 620-640.

Grimmett, R., Inskipp, C., and Inskipp T. 1998. Birds of the Indian Subcontinent, Oxford University Press, Delhi. 887pp.

Jones, D.N., Dekker, R.W.R.J., and Roselaar, C.S., 1995. The Megapodes. *Oxford University Press*. 262 pp.

Sankaran, R. 1995. The distribution, status and conservation of the Nicobar Megapode *Megapodius nicobariensis*. *Biological Conservation*, 72, 17-25.

Sivakumar, K. 2007. The Nicobar megapode: Status, ecology and conservation aftermath tsunami. Research Report No. RR 07/002, Wildlife Institute of India, 49 pp.

Sivakumar, K and Sankaran, R. , 2003. Incubation mound and hatching success of the Nicobar Megapode *Megapodius nicobariensis*. *Journal of Bombay Natural History Society*. 100 (2and3): 375-387

Sivakumar, K and Sankaran, R. . 2005. Natural history notes on chicks of the Nicobar Megapode *Megapodius nicobariensis*. *Journal of Bombay Natural History Society*. 101(3):452-453

Sivakumar, K. 2000. A study on breeding biology of the Nicobar megapode *Megapodius nicobariensis*. Unpublished Doctoral Thesis, Bharathiyar University, Tamil Nadu - 240 pp.



Nicobar megapode *Megapodius nicobariensis* Blyth, 1846

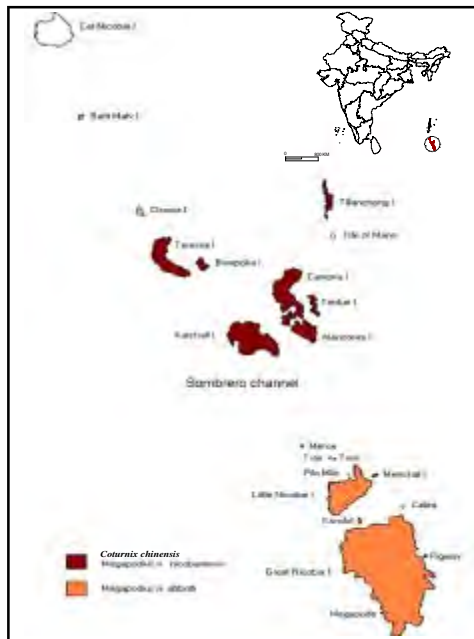
Vernacular Names: *Kongah* (Nicobar), *Jungle murghi* (Hindi),



K. Sivakumar

Distribution & Habitat

The mound nesting Nicobar megapode is endemic to the Nicobar islands. Historically, the Nicobar Megapode occurred on most Nicobar islands barring Car Nicobar, Chaura and Bati Malv. There were a few records from the Andaman group of islands and from the Coco Islands further north. None of the records from the Andaman group are of recent origin and the species is now believed to be absent there. Two sub-species of the Nicobar megapode occur in the Nicobar group of islands. *M. n. nicobariensis* occur in Nancowry group of islands and *M.n. abbotti* occurs in Southern group of Nicobar islands. After the 2004 tsunami, the Nicobar megapode continues to be found on all but two islands viz., Trax and Megapode where it had been reported earlier. The Megapode Island was fully submerged due to rise in sea water level after tsunami. The Nicobar megapode was not found on Trax Island and it was believed that the bird probably became extinct here due to tsunami waves. After tsunami, the global status of the Nicobar megapode is proposed to change from Vulnerable to Critically Endangered.



Conservation Status

IUCN : vulnerable
IWPA : Schedule I
CITES : Not listed

It inhabits forests and secondary growth, with greatest concentrations in coastal forests. Nicobar megapode prefer a narrow strip of flat coastal forest for mound nesting. Moreover, the distribution and density of the Nicobar Megapode and its mound varies within this coastal habitat. Small population of megapodes also occur in interior islands.

Description

The Nicobar Megapode is a terrestrial brown or reddish-brown bird with a pinkish-red bare patch around the eye and a greyish crown; the dorsal side of the leg is blackish-brown and the ventral side yellowish. Newly-hatched chicks have the crown, upperparts, and upper wing rufous brown, and the under parts a dull cinnamon-brown, sometimes with slight grey tinge, with the lower back inconspicuously rufous and black.

Size, Habitat & Altitude Range

Body Length : 43 cm
Weight : 595-1021 g
Habitat : Undergrowth in thick forests adjacent to sandy beaches on islands
Altitude : up to 800m

Behaviour

They are usually seen in pairs in forests close to the beach, the sexes looks alike. It incubates its eggs in nest-mounds close to the shore which are built from sand, loam and humus. This is presumed to rely on microbial decomposition. The species is primarily monogamous, although extra-pair copulations have been observed. Male gives loud territorial calls, rising in pitch and grading into a staccato series. Feeding birds give noisy, cackling contact calls. In a pair, both the male and female contribute to the mound maintenance. Unpaired mature males build and defend mounds to attract a partner. Several pairs often share nest-mounds, with a strong hierarchy apparent during egg-laying. Annual hatching success fluctuates widely (e.g. 87% in 1996 cf. 37% in 1997). Chicks are precocial.

Reproduction & Life Cycle

Call : *kyouououou-kyou-kou-koukukoukou, kuk-a-kuk-kuk*
Egg Laying Season : November to May
Nest Site/ Type : mounds of sand and rotting vegetation
Clutch Size : 2 to 4
Incubation Period : 70-80 days



2.0 Partridges, Quails, Francolins and Snowcocks

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Partridges, Quails, Francolins, and Snowcocks in India add up to 27 species (see Table). They belong to family Phasianidae. In this Chapter, we present the Species Accounts for these species in a field guide format that would provide information at a glance. We have collated information largely from Ali and Ripley (1983), Johnsgard (1988), McGowan *et al.* (1995), Grimmet, Inskipp and Inskipp (1998), and Madge and McGowan (2002). Other works that were consulted are given in the References below. We have followed Monroe and Sibley (1993) for taxonomic sequence, and Inskipp, Lindsey and Duckworth (1996) for common names. For currently valid scientific names, we have followed emendations as and when adopted by the British Ornithologists Union, Clements checklist (2004), Howard and Moore's checklist (Dickinson 2003), Oriental Bird Club checklist by Inskipp *et al.* (1996), Allan Peterson's zoonomen database and other taxonomy publications in peer reviewed journals. Species illustrations are from the book "Pheasants, Partridges and Grouse" by Madge and McGowan (2002), A and C Black (Publishers) Ltd., London.

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- Alan Peterson's World Bird Nomenclature Database <http://www.zoonomen.net/avtax>
- Ali, S and Ripley, S.D. 1983. Handbook of the Birds of India and Pakistan. Compact Edition. Bombay Natural History Society, Oxford University Press, Delhi. 737pp.
- Clements, J.F. 2000. Birds of the World: A Checklist. Fifth Edition (Updated 2004). Ibis Publishing Company, Temecula, CA, USA. 846pp.
- Dickinson, E.C. (Ed.) 2003. The Howard and Moore Complete Checklist of the Birds of the World: Third Edition. Princeton University Press, New Jersey, USA. 1056pp. (Accessed through Avibase database of Denis Lepage: <http://www.bsc-eoc.org/avibase>).
- Grimmett, R., Inskipp, C., and Inskipp T. 1998. Birds of the Indian Subcontinent, Oxford University Press, Delhi. 887pp.
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- Johnsgard, P.A. 1988. The Quails, Partridges and Francolins of the World. Oxford University Press. Oxford
- Madge, S., and McGowan, P. 2002. Pheasants, Partridges and Grouse. Christopher Helm, A and C Black (Publishers) Ltd., London. 488pp.
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- Monroe, B.L., and Sibley, C.G. 1993. A World Checklist of Birds. Yale Univ. Press, New Haven, USA.



Partridges, Quails, Francolins and Snowcocks of India

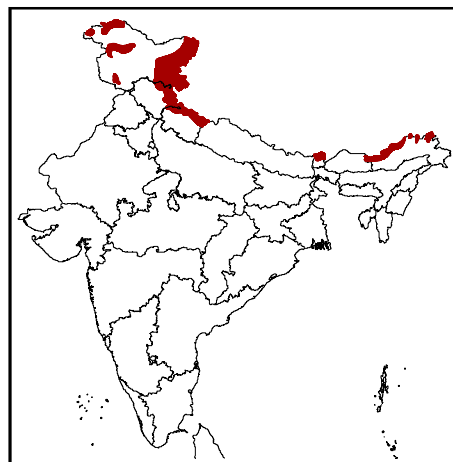
S.NO.	COMMON NAME	SCIENTIFIC NAME
1	Snow Partridge	<i>Lerwa lerwa</i>
2	Tibetan Snowcock	<i>Tetraogallus tibetanus</i>
3	Himalayan Snowcock	<i>Tetraogallus himalayensis</i>
4	Buff-throated Partridge	<i>Tetraophasis szechenyii</i>
5	Chukar	<i>Alectoris chukar</i>
6	Black Francolin	<i>Francolinus francolinus</i>
7	Painted Francolin	<i>Francolinus pictus</i>
8	Chinese Francolin	<i>Francolinus pintadeanus</i>
9	Grey Francolin	<i>Francolinus pondicerianus</i>
10	Swamp Francolin	<i>Francolinus gularis</i>
11	Tibetan Partridge	<i>Perdix hodgsoniae</i>
12	Common Quail	<i>Coturnix coturnix</i>
13	Japanese Quail	<i>Coturnix japonica</i>
14	Rain Quail	<i>Coturnix coromandelica</i>
15	Blue-breasted Quail	<i>Coturnix chinensis</i>
16	Jungle Bush Quail	<i>Perdica asiatica</i>
17	Rock Bush Quail	<i>Perdica argoondah</i>
18	Painted Bush Quail	<i>Perdica erythrorhyncha</i>
19	Manipur Bush Quail	<i>Perdica manipurensis</i>
20	Hill Partridge	<i>Arborophila torqueola</i>
21	Rufous-throated Partridge	<i>Arborophila rufogularis</i>
22	White-cheeked Partridge	<i>Arborophila atrogularis</i>
23	Chestnut-breasted Partridge	<i>Arborophila mandellii</i>
24	Mountain Bamboo Partridge	<i>Bambusicola fytchii</i>
25	Red Spurfowl	<i>Galloperdix spadicea</i>
26	Painted Spurfowl	<i>Galloperdix lunulata</i>
27	Himalayan Quail	<i>Ophrysia superciliosa</i>

**SNOW PARTRIDGE** *Lerwa lerwa* Hodgson 1833

Vernacular Names: *Quir* or *Kur monal* (Garhwali), *Janguria* (Kumauni), *Barf ka titar* (Himachali-Kullu), *Biju* (Himachali-Chamba), *Lerwa* (bhotia)



Daniel Cole

**Distribution & Habitat**

Resident and fairly common in the Himalayas (Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh) between 4,000 and 5,000m in summers, and down to 3,050 m in winter, but never <2,500 m. Inhabits alpine scrub and meadows close to the snowline on steep rocky or grassy slopes interspersed with scattered dwarf juniper or *rhododendron* bushes.

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Description

A high-altitude close-barred, partridge with bright red legs and bill. The upperparts are closely barred black and white, the underparts is largely deep chestnut, broadly streaked with whitish on abdomen and flanks. The under tail coverts are chestnut, streaked with black and tipped with whitish. While in flight, shows a narrow white trailing edge to the wings. Sexes alike.

Size, Habitat & Altitude Range

Body Length : 38 cm
Weight : 454-709 g
Habitat : steep rocky/grassy slopes with juniper or rhododendron scrub near snowline
Altitude : 3,000-5,500 m

Behaviour

During spring, usually in pairs and later in family groups of up to 30 birds. It is very tame in areas where not hunted, standing on rock to watch the observer, rather than flying away. When flushed, the flock disperses, first raising up silently for a metre or two then plunging quickly downhill scattering without calling, but with a great whirring and clattering of wings

Reproduction & Life Cycle

Call : harsh frequently repeated whistle
Breeding Season : May-July
Nest Site/ Type : well hidden under rock or grass clump
Clutch Size : 3 to 5
Incubation Period : unknown

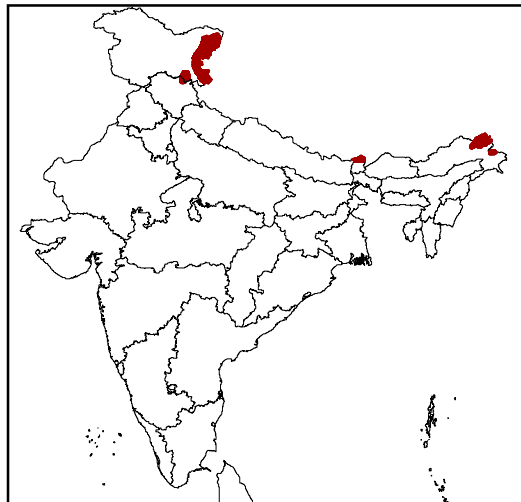


TIBETAN SNOWCOCK *Tetraogallus tibetanus* Gould 1854

Vernacular Names: *Hrak-pa* (Bhotia)



Daniel Cole



Distribution & Habitat

Resident and uncommon. In the Himalayas (Jammu & Kashmir, Sikkim & Arunachal Pradesh), up to 5,800 m (summer) and down to 3,000 m (winter) in the western Himalaya; and between 4,500 & 5,500 m (summer); and down to 3,650 m (winter) in eastern Himalaya. Inhabits alpine meadows and scrub, rocky ridges and slopes.

Conservation Status

IUCN : others
IWPA : Schedule I
CITES : I

Description

A stout, dumpy, high-altitude galliforme reminiscent of a huge overgrown Grey partridge and differs from the Himalayan Snowcock by the prominent white patch on ear-coverts against the grey head and neck and the double band of grey across upper breast. The sides of forehead, secondaries, throat are white. Back largely sandy grey and blackish grey, finely vermiculated and streaked with buff. Rump upper tail coverts and central tail feathers rufous, rest of tail blackish brown with rufous tips. Underparts largely white; throat and upper breast unmarked, followed by a grey band separating them from rest of underparts which are broadly streaked with black, the streaks broadest on flanks and lower abdomen. Legs red. Sexes differ slightly. The race of Western Himalaya is much paler and sandier above than the race of Central and Eastern Himalayas.

Size, Habitat & Altitude Range

Body Length : 51 cm
Weight : unknown
Habitat : barren rocky slopes with sparse scrub or meadows
Altitude : 3,000-5,800 m

Reproduction & Life Cycle

Call : cour-lee-whi-whi
Breeding Season : May-August
Nest Site/ Type : under stones/rock on leeward side
Clutch Size : 8 to 16
Incubation Period : unknown

Behaviour

Stays in pairs in the breeding season and later in groups of up to 30 birds. Escapes by running uphill or, if disturbed, by flying swiftly downhill for a long distance before settling again. Flicks its heavy tail as it walks, showing the white undertail-coverts. Calls frequently, a subdued chuckling which gradually becomes louder and louder until it reaches a kind of climax, a whistle, and a call strangely reminiscent of Eurasian curlew.



HIMALAYAN SNOWCOCK *Tetraogallus himalayensis* Gray 1843

Vernacular Names: *Jer Monal* (Garhwali), *Huinwal* (Kumauni), *Leep* (Himachali-Kullu), *Galaond* (Himachali-Chamba), *Gleund* (Himachali-Kangra), *Kabak*, *Gura kakov*, *Ramchakor* (Kashmiri)



Daniel Cole



Distribution & Habitat

Resident and fairly common. In the Himalayas (Jammu & Kashmir, Himachal Pradesh & Uttarakhand) from 4,000 to 5,500 m (summer) and down to 2,100 m in W Himalayas. Inhabits alpine meadows and scrub near the snowline, bare stony ridges and steep slopes.

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Description

Similar to the Tibetan Snowcock largely grey, white, chestnut and black streaked and vermiculated plumage. The white throat, separated by a broken chestnut collar from the dark grey underparts, and white under tail-coverts, are distinguishing characters. There is a strong contrast between pale grey crown/mantle and dark grey back. It lacks white striping on scapulars and coverts which is a striking feature of the Tibetan Snowcock. While in flight, Himalayan Snowcock shows extensive white in primaries but little or no white in secondaries.

Size, Habitat & Altitude Range

Body Length : 72 cm
Weight : 1,360-3,000 g
Habitat : alpine meadows, steep slopes
and stony ridges near snowline
Altitude : 3,000-5,800 m

Reproduction & Life Cycle

Call : *cour-lee-whi-whi*,
chok-chok-chok
Breeding Season : April-June
Nest Site/ Type : under stones/rock on leeward side
Clutch Size : 5 to 7
Incubation Period : 27-28 days

Behaviour

Usually in pairs (breeding season), or parties of 3-5 although coveys of >20 birds are frequently observed. They shoot downhill in the morning to drink and slowly work their way upwards feeding as day warms up, scratching the ground and digging vigorously with their stout bills. They hardly fly uphill or flap their wings in flight except before alighting. When alarmed, escapes by running uphill like a waddling goose-like gait, its colouration blending to perfection with the barren environment or flying swiftly downhill for a long distance without a single wing beat before settling again. Flicks its heavy tail as it, walks, showing the white undertail-coverts. They are noisy birds continually uttering clucking calls as they feed, and shrill cackles of alarm, when flushed as well as on the wing.

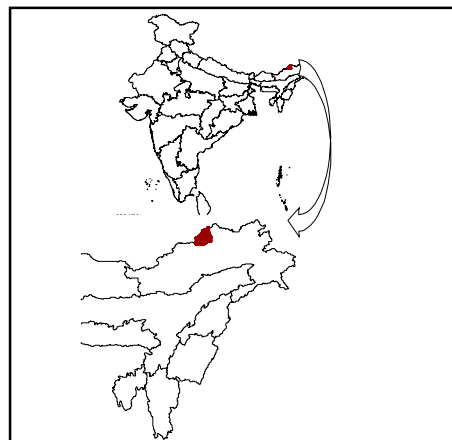


BUFF-THROATED PARTRIDGE *Tetraophasis szechenyii* Madarasz 1885

Vernacular Names: *Kwa-kwa-dzi kuling* (Tibetan)



Daniel Cole



Distribution & Habitat

Resident and rare. In Upper Subansiri and Siyom drainage areas of Arunachal Pradesh. It occurs between 3,350m and 4,600 m. Inhabits well-vegetated rocky ravines or fir forest and *rhododendron* scrub in subalpine and alpine zones.

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Description

A very large plain coloured galliforme with long and broad white-tipped tail and is likely to be confused only with the female Sclater's Monal that also occurs in its distribution range, but lacks white rump and prominent mantle streaking of that species. Diagnostic features are bare red skin around eyes; orange-buff throat; greyish breast, spotted with black;

Size, Habitat & Altitude Range

Body Length : 64 cm
Weight : unknown
Habitat : well-vegetated rocky ravines, fir forest, rhododendron scrub in subalpine & alpine zones
Altitude : 3,350-4,600 m

prominent orange-buff and chestnut spotting on belly and flanks; uniform grey crown/ear-coverts and uniform brown mantle; grey rump; and broad buffish and white tips to the wing-coverts, secondaries, tertials and scapulars. Sometimes occurs above the treeline and could be confused with Tibetan Snowcock, but dark underparts, white tip to tail and lack of white in the wing on Buff-throated help in identification even from a distance.

Behaviour

Usually in groups of four to six birds. When disturbed, it escapes into trees and 'freezes' becoming well camouflaged and difficult to detect. If flushed in open areas, where it has frozen on the observer's approach, it rises with a whirr of wings and plummets downhill and into the nearest forest cover. Roosts on trees. A quieter bird and has a loud harsh series of notes difficult to describe.

Reproduction & Life Cycle

Call : series of harsh, anxious cries
Breeding Season : unknown
Nest Site/ Type : unknown
Clutch Size : unknown
Incubation Period : unknown

**CHUKAR *Alectoris chukar* Gray 1830**

Vernacular Names: *Chukor* (Hindi), *Chakru* (Himachali-Chamba), *Kakov* (Kashmiri)



Robin Budden

**Distribution & Habitat**

Resident and fairly common in the Himalayas (Jammu & Kashmir, Himachal Pradesh & Uttarakhand) largely between 1,200m and 3,960m. It inhabits open, arid rocky hills, barren hillsides with scattered scrub, grassy slopes, and in areas near dry terraced cultivated river valleys often near a water source.

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Description

A large plump and sleek pinkish grey-brown partridge with rufous tail and conspicuous rib-like bars on flanks in buff and black. A black band running across forehead back through the eyes and undersides of neck to as a 'necklace' on upper breast enclosing the buffy to glistening white cheeks, chin and throat. Red bill and legs. While in flight, it displays rufous corners to tail. Sexes alike, but the females are slightly smaller and lack spur on the tarsus.

Size, Habitat & Altitude Range

Body Length : 38 cm
Weight : 370-765 g
Habitat : open, arid rocky slopes, barren hillsides with grassy slopes and scattered scrub, terraced fields, stony ravines
Altitude : 1,200-5,000 m

Behaviour

Keeps in parties of 4-5 birds but flocks of up to 50 birds outside the breeding season. If flushed, the covey disperses, flying very fast and strongly but the flight is not sustained, and in hilly regions flies downhill hugging the contours. They move with speed and agility over rough ground. The male has a rattling crow uttered from an exposed rock or other vantage point in the early morning and late evening with a particularly ring in the breeding season. It is a loud chuckling far reaching call.

Reproduction & Life Cycle

Call : chuck, chuck-aa, chuck-chuk-chuk
Breeding Season : April-August
Nest Site/ Type : under a rock, bush or tussock on a rocky slope
Clutch Size : 7 to 12
Incubation Period : unknown

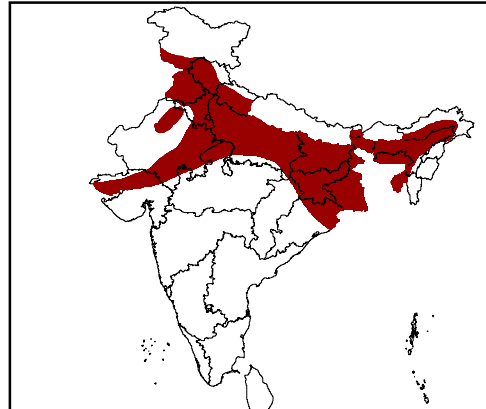


BLACK FRANCOLIN *Francolinus francolinus* Linnaeus 1766

Vernacular Names: *Kala teetar* (Hindi)



Norman Arlott



Distribution & Habitat

Resident and common in the lower Himalayas (Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim & Arunachal Pradesh) up to 2,100m, plains of northwest, east and northeast India. Inhabits, cultivated areas, tea estates and tall grass and scrub, especially near rivers and canals, as it requires good ground cover and water.

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Description

A plump, stub-tailed galliforme where the male is unmistakable, with white ear-covert patch on otherwise black face, rufous collar, black upper mantle spotted with white, and black underparts with flanks boldly spotted with white. The female is paler and browner, with no white cheek patches or chestnut collar, only a dull chestnut patch on nape. Below, chin and throat are buffy white; rest of the underparts and flanks are heavily barred with black. Vent and under tail-coverts are chestnut.

Size, Habitat & Altitude Range

Body Length : 34 cm
Weight : 227-566 g
Habitat : Cultivated areas, tall grass and scrub, especially near rivers and canals, tea gardens
Altitude : <2,500 m

Reproduction & Life Cycle

Call : kar-kar, kee, ke-kee
Breeding Season : March-October
Nest Site/ Type : among grasses, dense scrub or agriculture fields
Clutch Size : 6 to 9
Incubation Period: 18-19 days

Behaviour

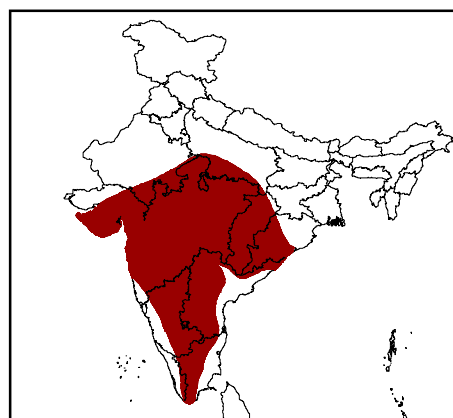
Found solitary, in pairs or in groups of up to 5 birds. It roosts in thick ground cover such as tall grass clumps or sugarcane fields and leaves for more open crops and grassland for feeding. It is active in early morning and late afternoon, returning into cover during mid day. When disturbed, escapes by running away swiftly, but otherwise flushes easily, flying off strongly and at great speed. During the breeding season, calls at any time of the day often from a tree or stump. Call is loud, penetrating and a curious blend of the harsh and the musical and has a peculiar far reaching ventriloquistic quality. The call is repeated at intervals of 15 seconds or so, several birds answering one another from all directions.

**PAINTED FRANCOIN** *Francolinus pictus* Jardine and Selby 1828

Vernacular Names: *Titur*, *Chitur* (Hindi), *Kakera kozhi* (Tamil), *Kala titur* (Marathi)



Norman Arlott

**Distribution & Habitat**

Resident and fairly common. It is distributed from Gujarat north to south Uttar Pradesh, east to Orissa and south through the Indian peninsula. It generally occurs in water and thicker habitats such as undulating tall thick grassland and cultivation with scattered trees and bushes, also glades in thin forest; partial to thick cover.

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Description

Similar to female Black Francolin and both sexes of Grey Francolin but could be distinguished by rather plain rufous-orange face and throat, bold white spotting on blackish mantle, and spotted appearance to underparts. Sexes are very similar in colour; some females have white throat and/or less heavily spotted mantle with buff edges to dark-centred feathers giving rise to streaked-looking lower mantle. It is distinguished from Grey Francolin by spotted and streaked appearance of upperparts. Spur absent in both sexes.

Size, Habitat & Altitude Range

Body Length : 31 cm
Weight : 242-340 g
Habitat : wetter & thicker open grass plains, thorn scrub, near dry cultivation & drier areas
Altitude : <1,000 m

Reproduction & Life Cycle

Call : *click..cheek..cheek-keray*
Breeding Season : March-October
Nest Site/ Type : mixed grass & scrub, sugar cane or other crops
Clutch Size : 4 to 8
Incubation Period : unknown

Behaviour

Usually keeps in pairs, sometimes in family groups. Leaves cover to feed in early morning and late afternoon. Very skulking, and if disturbed it will escape into cover. Roosts in trees as well as on the ground where canopy is by arching grass. Call very similar to that of the Black Francolin almost indistinguishable from it. Calls from a tree stump, mound, or other elevated site once every 20 seconds or so, frequently for over 15 minutes at a stretch.

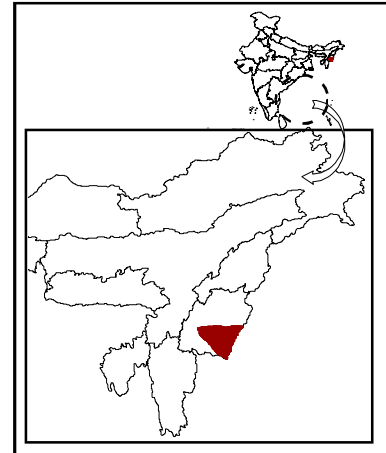


CHINESE FRANCOLIN *Francolinus pintadeanus* Scopoli 1786

Vernacular Names: *Kabo urenbi* (Manipuri)



Norman Arlott



Distribution & Habitat

Very local Resident and rare in SE Manipur in the Kabaw and Manipur valleys, common in drier areas. Dry open dipterocarp forest and oak scrub in undulating or hilly country

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Description

Distinguished from Black Francolin in silhouette by heavier head and thicker neck. Male easily distinguished by orange-buff sides of crown, black moustachial stripe that divides white throat from white ear-coverts, absence of rufous on hindneck, and extensive white spotting on upperparts, rufous in scapulars, and extensive white spotting on black breast and belly. Female like male but duller, and white underparts are barred with black. Absence of rufous on hindneck, extensive white spotting on mantle, bold black moustachial stripe, and barred patterning to scapulars are distinguishing features.

Size, Habitat & Altitude Range

Body Length: 33 cm
Weight : 284-397 g
Habitat : dry open dipterocarp forest, oak scrub in hills
Altitude : <3,000 m

Reproduction & Life Cycle

Call : *wi-ta-tak-takaa*
Breeding Season : unknown
Nest Site/ Type : scrub jungle or grass
Clutch Size : 3 to 7
Incubation Period : unknown

Behaviour

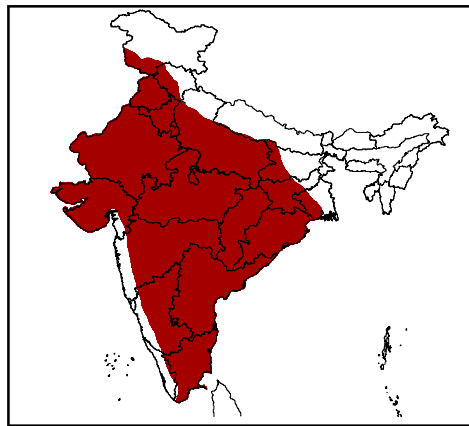
Usually found singly or in pairs and threes, but not in groups. A skulker that remains under cover. It is a stronger flier than the Black francolin. Often heard than seen. Call is a loud, harsh, metallic, repeated after fairly long intervals and are made from a tree stump or branch up to 3 m high. The call is five noted and unusually resonant and is given mostly in the early mornings and at dusk when several birds may be heard calling simultaneously.

**GREY FRANCOLIN** *Francolinus pondicerianus* Gmelin 1789

Vernacular Names: *Tetair*, *Ram teetar*, *Safed Teetar*, *Gora Teetar* (Hindi), *Kauthari* (Tamil), *Kawanga* (Telugu), *Kozhi kata* (Malayalam), *Gowjal hakki* (Kannada); *Kondari*, *Chitur* (Marathi), *Jhirufti* (Punjabi), *Khyr* (Bengali)



Norman Arlott

**Distribution & Habitat**

Resident and common from the plains of Jammu & Kashmir in the west to West Bengal in the east and south through the peninsula. Introduced in Andaman Islands in 1890. Inhabits dry open grassy undulating plains and thorn scrub, often near dry cultivation near villages, also stony semi-desert and sand dunes.

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Description

A squat, stub-tailed galliforme largely grayish brown, rufous and chestnut above, mottled, barred and vermiculated with buff and black. Underparts are pale buff and rufous, narrowly cross-banded on fore-neck and upper breast and finely vermiculated on abdomen and flanks with black. Has a prominent yellowish rufous throat patch enclosed with a black spotting loop, chestnut, grey-brown and dark brown barring to upperparts, and chestnut on tail in flight. Sexes alike, but males are slightly larger and have sharp spurs.

Behaviour

Usually found in pairs or in groups of up to eight birds, which roost together in small thorny trees or by squatting on the ground within dense thorny shrubs. It is well adapted to drought conditions. It escapes by running and seldom fly, but when disturbed rises with a loud whirr of wings and alights again after only 50-100m. Call is harsh and rapidly repeated or a softer whistle like. Grey francolins have been observed successfully defending their brood of very small chicks by actually attacking and fighting off a group of marauding Crows *Corvus splendens*¹. Male calls from a vantage point.

Size, Habitat & Altitude Range

Body Length: 33 cm

Weight : 200-340 g

Habitat : dry open grass plains and thorn scrub, often near cultivation, stony semi-desert and sand dunes

Altitude : <1000 m

Reproduction & Life Cycle

Call : *khateejja- khateejja- khateejja, kila-kila-kila*

Breeding Season : March-October

Nest Site/ Type : under bush, rock or other shelter

Clutch Size : 4 to 8

Incubation Period : 18-19 days

¹ Kalsi, R.S. & Kalsi, R. 1993. Brood defence in Grey Francolin. *WPA-India News*, 1, 10.

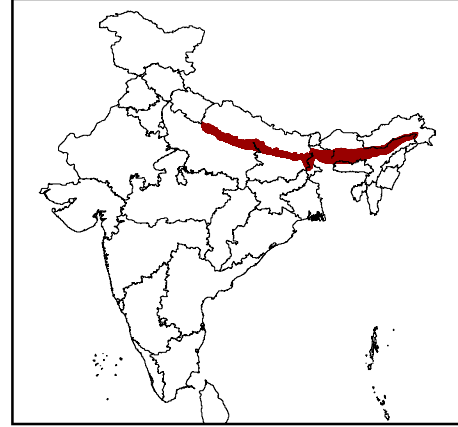


SWAMP FRANCOLIN *Fraulinus gularis* Temminck 1815

Vernacular Names: *Kyah, Khyr, Kaijah* (Bengali), *Bhil titri* (Bihari), *Koi, Koi sordi, Koira* (Assamese), *Bheel teetar, Gul teetar* (Assamese-Cachar)



Norman Arlott



Distribution & Habitat

Resident and fairly common in northern Uttar Pradesh and southern Nepal, east through northern Bihar and West Bengal to the Brahmaputra valley in north-eastern India and, at least historically, to parts of Bangladesh. Found at an altitudinal range of 50 – 200 m, its current distribution is fragmented. Presently it is confined to protected areas in the terai and plains.

It generally inhabits tall wet grasslands and swamps in the terai. It is commonly found near water using its unusually long legs for the genus, to wade through water with ease. It uses tall riverine grasslands, shorter *Imperata*-dominated grasslands, tall wet grasslands containing *Phragmites karka*, *Arundo donax*, *Themeda arundinaceum*, *Narenga porphyrocoma*, and particularly *Sclerostachya fusca* and *Saccharum*. Many a times it has been reported to use sugarcane fields adjacent to its natural habitats.

Conservation Status

IUCN : vulnerable
IWPA : Schedule IV
CITES : not listed

Size, Habitat & Altitude Range

Body Length : 37 cm
Weight : 510 g
Habitat : tall wet grasslands & swamps, also sugarcane fields near natural habitats
Altitude : <800 m

Description

A large and conspicuously long-legged francolin with a brown crown and nape. It could be distinguished from other francolins by the rufous-orange throat and fore neck, brown upperparts finely barred with buff, broad white streaking to brown underparts, and buff supercilium and cheek-stripe. Only males have spur and female has paler orange legs. As like Grey Francolin, shows chestnut on outer tail in flight.

Behaviour

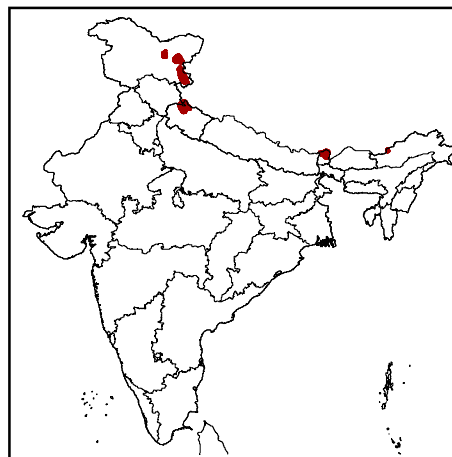
Usually found in pairs or in groups of up to six birds. It often wades in marshes, or climbs on to reeds in deep water. Feeds in open grasslands and fields, and when flushed, rises noisily with loud chuckling and whirring of wings. Call is loud and harsh.

Reproduction & Life Cycle

Call : *kew-care*, or *qua, qua, qua*, *chuckeroo, chuckeroo*, *chuckeroo*
Breeding Season : February-May
Nest Site/ Type : thick pad of vegetation among reeds in shallow water
Clutch Size : 4 to 5
Incubation Period : unknown

**TIBETAN PARTRIDGE *Perdix hodgsoniae* Hodgson 1857****Vernacular Names:** *Chak pa* (Ladhaki)

Robin Budden

**Distribution & Habitat**

Resident and fairly common. Extends marginally from Tibet into Northern India and Sikkim. Winters at 3,660-4,100 m (down to 2,800 m), summers up to 5,600m. In the Trans- Himalayan semi-desert and on rocky slopes with scattered *Caragana*, *Juniper*, and dwarf *Rhododendron* scrub.

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Description

A high altitude partridge similar to the grey partridge of the plains. Diagnostic features of adult are bold, black ear-covert patch on whitish face, rufous collar, bold black barring on underparts forming variable black patch on belly, and rufous barring on flanks.

Size, Habitat & Altitude Range

Body Length : 31 cm
Weight : 450 g
Habitat : Trans-Himalayan semi desert, rocky slopes with *Caragana* bushes and dwarf scrub
Altitude : 2,800-5,200 m

Behaviour

Usually keeps in groups of up to about 10-15 birds during non breeding season. Generally, very reluctant to fly. When disturbed, birds run fast uphill, giving a shrill call. If disturbed further, they run in different directions and fly downhill, re-establishing contact later by calling to each other.

Reproduction & Life Cycle

Call : *scherrreck-scherrreck*,
chee, chee, chee, chee
Breeding Season : May-July
Nest Site/ Type : under boulder or bush
Clutch Size : 8 to 10
Incubation Period : unknown

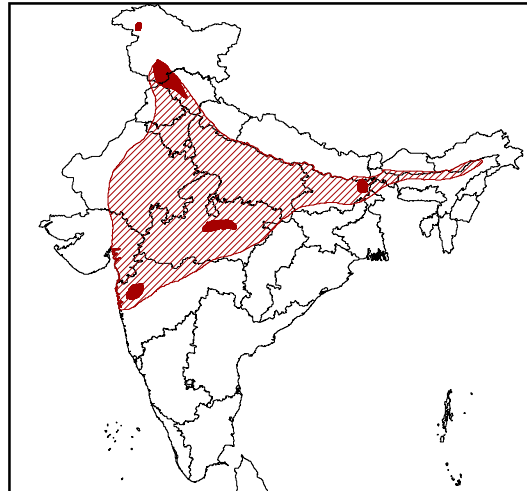


COMMON QUAIL *Coturnix coturnix* Linnaeus 1758

Vernacular Names: *Bater, Bada bater, Ghagus bater* (Hindi), *Kadai* (Tamil), *Gogari Yellich* (Telugu), *Barli, Sipale hakki* (Kannada), *Kata* (Malayalam), *Lowa, Bada ganga, Gurganj* (Marathi), *Bhatri* (Bengali), *Gundri* (Oriya), *Bota sordi* (Assamese) *Daobi kashiba* (Assamese-Cachar), *Soibol, Sorbal* (Manipuri),



Carl D'Silva



Distribution & Habitat

Common quail is a widespread, fairly common galliforme that is partly resident, and partly winter visitor. It breeds in Kashmir (up to 2,500 m) east through Bihar to Assam and south to Maharashtra. Widely but very locally reported as resident in the north; probably under-recorded. Formerly very common locally in some years, especially on migration, but has declined. It inhabits standing crops, paddy stubbles and grasslands, with vegetation dense and tall enough to conceal birds.

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Description

A plump and squat pale brown galliforme with conspicuous buff spear-shaped streaks and irregular mottling of reddish brown and black barring above in both sexes. It has stripy head pattern. In males, the chin and line centre of throat is black, and has two dark bands (sometimes indistinct) from the throat to ear coverts forming "anchor-shaped" pattern. Has a whitish gorget across foreneck, which is usually separated from breast by band of rufous or blackish blotching. Breast varies from warm buff to rufous, with pale buff shaft streaking. Rest of the underparts is creamy white. In females, 'anchor' marking on throat is absent, and has blackish spotting on buff breast.

Size, Habitat & Altitude Range

Body Length : 20 cm
Weight : 86-120 g
Habitat : standing crops, paddy stubbles, scrub & grasslands with tall and dense vegetation
Altitude : 2,135-3,150 m

Behaviour

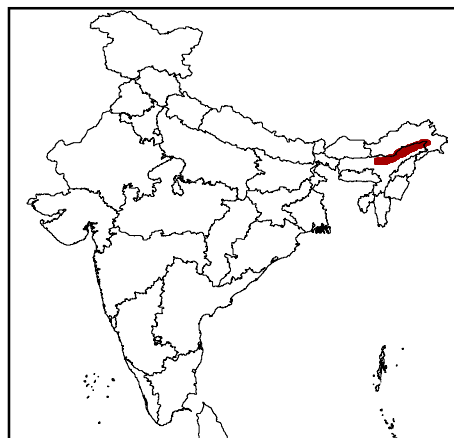
Usually occurs singly or in pairs. Very secretive and keeps out of sight. When flushed the bird rises almost vertically for a few feet with the typical partridge whirr of wings and a squeaky whistling note flying low on rapidly vibrating wings straight and fast for 100-200 m before dropping into the crops again. On arrival at breeding areas, males establish territories by calling persistently in early morning, evening and sometimes during the day or night. Call is far carrying and repeated in quick succession.

Reproduction & Life Cycle

Call : *whit, whit-tit, whree-chuk*
Breeding Season : March-July
Nest Site/ Type : herbaceous vegetation
Clutch Size : 6 to 8
Incubation Period : unknown

**JAPANESE QUAIL *Coturnix japonica* Temminck and Schlegel 1849****Vernacular Names:** *Bota sordi* (Assamese), *Sorbol* (Manipuri)

Carl D'Silva

**Distribution & Habitat**

Winter visitor and rare. It is reported to visit Assam south of Brahmaputra river in small numbers.

Conservation Status**IUCN** : others**IWPA** : Schedule IV**CITES** : not listed**Description**

As like the Common Quail, the Japanese Quail is also a plump and squat pale brown galliforme not distinguishable until in hand. During the breeding season, male has rufous face, throat and foreneck, with rufous often extending onto sides and upper part of breast. Some birds show faint dark 'anchor' marking on throat, as like Common Quail. Coloration and patterning of breast and flanks is variable. In non-breeding season, rufous colour on head is faint or absent, and head pattern is rather untidy and variable. Female indistinguishable from female Common Quail.

Size, Habitat & Altitude Range**Body Length** : 20 cm**Weight** : unknown**Habitat** : standing crops, paddy stubbles, scrub & grasslands with tall and dense vegetation**Altitude (m)** : unknown**Reproduction & Life Cycle****Call** : *choo-ee-trrr*,
*churck-churr***Breeding Season** : unknown**Nest Site/ Type** : unknown**Clutch Size** : 6 to 8**Incubation Period** : unknown**Behaviour**

Usually occurs singly or in pairs. Very secretive and keeps out of sight. When flushed the bird rises almost vertically for a few feet with the typical partridge whirr of wings and a squeaky whistling note flying low on rapidly vibrating wings straight and fast for 100-200 m before dropping into the crops again. Call is soft and muted, but the notes much harsher and blurred compared with Common Quail.

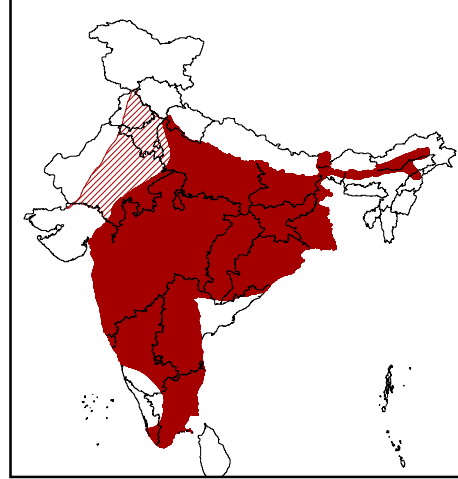


RAIN QUAIL *Coturnix coromandelica* Gmelin 1789

Vernacular Names: *China bater* (Hindi), *Kadai* (Tamil), *Chinna yellichi* (Telugu), *Kata* (Malayalam), *Chinaga bater* (Gujarati)



Carl D'Silva



Distribution & Habitat

Resident, widespread and locally fairly common, mostly in the plains and hills of peninsular India and up to 2,000 m in the Himalaya. Inhabits standing crops, grasslands, grasslands, paddy stubbles, and grass and scrub jungle.

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Description

Very similar to Common and Japanese Quails, but slightly smaller, with prominent crown -stripe and supercilium, and buff shaft streaking on mantle. Compared with those species, male Rain Quail has more dark marks on face and an anchor mark on the throat, more jet-black contrasting strongly with the white cheeks. The eye-stripe and moustachial, and black lower border to white band across fore neck are prominent. Also, shows extensive black patch on underparts, contrasting with cinnamon-pink sides of neck and sides of breast, and bold black streaking on flanks. Female is very similar to female Common Quail, but primaries are unbarred.

Size, Habitat & Altitude Range

Body Length : 18 cm
Weight : 64-85 g
Habitat : standing crops, grasslands, paddy stubbles, grass & scrub jungles
Altitude : <2,000 m

Behaviour

As like Common Quail. It is solitary or found in pairs, or sometimes in groups of up to six birds. It is frequently heard throughout the day during the monsoon especially when breeding. When disturbed, makes a short squeaky whistling note. The call is loud metallic and high pitched.

Reproduction & Life Cycle

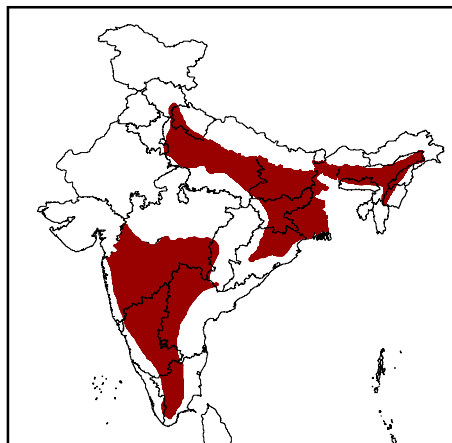
Call : *whit-whit*
Breeding Season : March-October
Nest Site/ Type : standing crops or thin grass
Clutch Size : 6 to 8
Incubation Period : 18-19 days

**BLUE-BREASTED QUAIL *Coturnix chinensis* Linnaeus 1766**

Vernacular Names: *Gurru* (Bengali), *Daobui majungbi* (Assamese-Cachar), *Sorbol* (Manipuri), *Mul* (Nicobari)



Carl D'Silva

**Distribution & Habitat**

Resident, occurs widely but uncommon and it is distributed sparsely and patchily in small numbers, and some nomadic movements during monsoon. It occurs mainly in the plains, also up to 2,000 m in peninsular hills. It is distributed from Punjab east to Assam, and south to Tamil Nadu with a possible gap in central gap and also found in Nicobar islands. Inhabits wet grassland, marshes, paddy-field edges, dense grass at roadsides and scrub.

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Description

A diminutive dark quail with bright yellow legs and sexually dimorphic. Diagnostic features of male are uniform slaty-blue forehead, supercilium, sides of neck, breast and flanks, black-and-white patterning on head and fore neck, and reddish-chestnut belly and under tail-coverts. The extent of red-dish-chestnut below varies, in some cases extending to reach white band across fore neck. Patterning of above also varies; some show blue-grey on crown, mantle and scapulars. In case of others, it is more rufescent-brown with bold whitish shaft streaking upperparts, with darker brown crown and clearly defined crown-stripe. The diagnostic features of female from female Common, Japanese and Rain Quails is smaller size, rufous forehead and broad supercilium, and barred breast and flanks. In addition, crown-stripe is finer, as is shaft streaking on hind neck, mantle and scapulars. Flight feathers are unbarred - another difference from Common and Japanese.

Size, Habitat & Altitude Range

Body Length : 14 cm
Weight : 36-57 g
Habitat : wet grassland, marshes, paddy-field edges, dense grass and scrub
Altitude : <2,000 m

Behaviour

Similar to those of Common Quail, but more partial to wetter terrain. Keeps in pairs or small family groups. Usually flush singly dropping into the grass after a short flight. Call is a high-pitched series of two or three descending piping notes.

Reproduction & Life Cycle

Call : *ti-yu, quee-kee-kew*
tir..tir
Breeding Season : December-September
Nest Site/ Type : grass clump close to thick cover
Clutch Size : unknown
Incubation Period : unknown

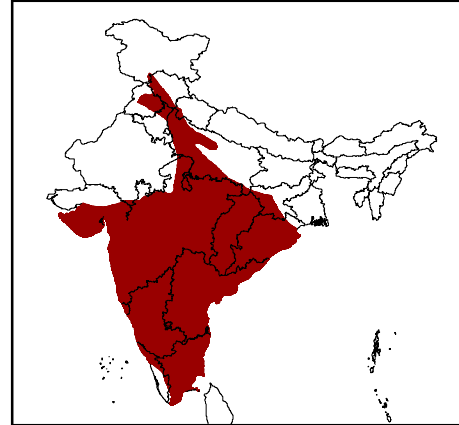


JUNGLE BUSH QUAIL *Perdica asiatica* Latham 1790

Vernacular Names: *Lowwa* (Hindi, Marathi), *Kadai* (Tamil), *Girza pitta* (Telegu), *Vari kada* (Malayalam), *Kari lowya* (Kannada), *Vana lavdri* (Gujarati)



Daniel Cole



Distribution & Habitat

Widespread resident, fairly common and endemic to the Indian subcontinent. From Gujarat east to Orissa, north to Himachal Pradesh (up to 1,200 m) and south throughout the peninsula. It inhabits dry grass and scrub jungle and both open and fairly dense deciduous forest, preferably on dry and stony ground.

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Description

A squat and plump little galliforme. Male is fulvous-brown streaked and mottled with black and buff. It has rufous orange throat and supercilium whitish moustachial stripe, brownish ear-coverts, and orange-buff vent. It has white underparts heavily barred with black, and is very similar to male Rock Bush Quail. Female has vinous-buff underparts, without black barring. It differs from female Rock Bush Quail by striking head pattern, which is much as male jungle, with rufous-orange throat distinct from rest of under parts.

Size, Habitat & Altitude Range

Body Length : 17 cm
Weight : 57-82 g
Habitat : dry grass & scrub jungle, open & fairly dense deciduous forests, preferably on dry and stony ground
Altitude : unknown

Reproduction & Life Cycle

Call : *chee-chee-chuck, chee-chee- chuck, whi-whi-whi-whi-whi-whi*

Breeding Season : Throughout

Nest Site/ Type : base of grass tussock in scrub

Clutch Size : 4 to 8

Incubation Period: 16-18 days

Behaviour

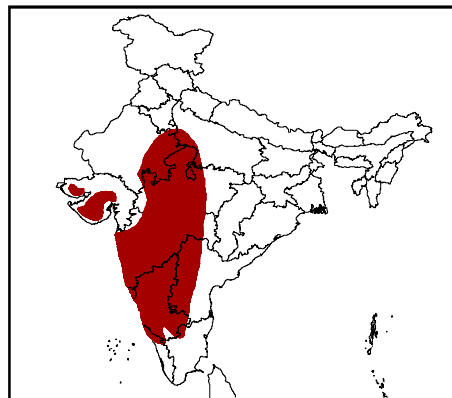
Found in groups of up to 20 birds outside the breeding season. When roosting or resting during the day, the birds bunch up together under a bush facing outward. When flushed, the burst into flight in all directions with a loud whirring of wings; they soon reassemble by making rallying calls to each other. They move in more or less single file, and shift from one feeding ground to another using the same little paths or tunnels formed in the matted and bent-over grass day after day. Cocks are pugnacious in breeding season. Call is harsh grating or soft musical whistling after a group has been scattered.

**ROCK BUSH QUAIL** *Perdica argoondah* Sykes 1832

Vernacular Names: *Lowwa* (Hindi, Marathi), *Sinna kada* (Tamil), *Lawunka* (Telugu)



Daniel Cole

**Distribution & Habitat**

Resident and fairly common, from Haryana south to north Kerala, and from Gujarat east to central Madhya Pradesh and central Andhra Pradesh. Inhabits dry rocky or sandy areas thinly vegetated with thorn scrub. When compared to Jungle Bush Quail, it is usually found in much thinly vegetated and stonier habitats.

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Description

A squat and plump galliforme where the male is easily confused with Jungle Bush Quail due to the white under parts that is heavily barred with black, but could be distinguished by subtle differences in head pattern. It has duller, more vinaceous-buff throat, creamy white superciliary stripe, and lacks white moustachial stripe. It also has a buffish-white vent. Female has vinaceous to vinaceous-buff below without black barring.

Behaviour

Similar to those of Jungle Bush Quail. Found in parties of up to 20 birds outside the breeding season. When roosting or resting during the day, the birds bunch up together under a bush facing outward. When flushed, the burst into flight in all directions with a loud whirring of wings; they soon reassemble by making rallying calls to each other. They move in more or less single file, and shift from one feeding ground to another, using the same little paths or tunnels formed in the matted and bent-over grass day after day. Cocks are pugnacious in breeding season. Call is harsh grating or soft musical whistling after a group has been scattered.

Size, Habitat & Altitude Range

Body Length : 17 cm
Weight : 60-74 g
Habitat : dry rock & sandy areas, thinly vegetated with thorn scrub, less vegetated and stony habitats
Altitude : unknown

Reproduction & Life Cycle

Call : *chee-chee-chuck, chee-chee-chuk, whi-whi-whi-whi-whi-whi*
Breeding Season : Throughout
Nest Site/ Type : under rock, bush or grass tussock
Clutch Size : 4 to 8
Incubation Period : 16-18 days

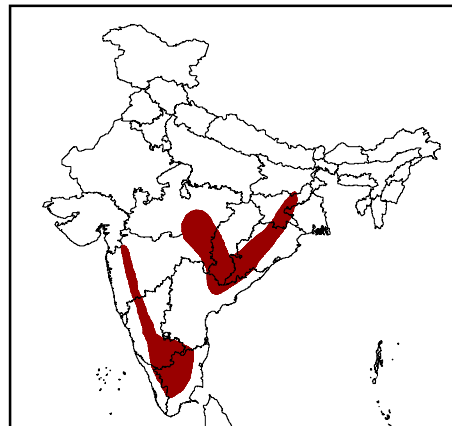


PAINTED BUSH QUAIL *Perdica erythrorhyncha* Sykes 1832

Vernacular Names: *Kokni lowwa* (Hindi), *Sirse lowwa*, (Hindi-Madhya Pradesh), *Kadai* (Tamil), *Meni kada* (Malayalam), *Huker* (Bengali)



Daniel Cole



Distribution & Habitat

Resident and fairly common, mainly in Western and Eastern Ghats, locally distributed and common between 600 and 2,000 m. Inhabits thin scrub, and scrub at forest edges often interspersed with cultivation.

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Description

A dark but brightly coloured galliforme with conspicuous bright bill and feet. It has bold black spotting on olive brown upperparts, bold black spotting on breast and, especially, on rufous flanks, and prominent white shaft streaks on scapulars and wing-coverts. Male has supercilia meeting across fore crown, black around eye, on forehead and on chin, and striking white throat. Female has fewer or no black spots on breast. It has rufous supercilium, lower ear coverts and throat.

Size, Habitat & Altitude Range

Body Length : 18 cm
Weight : 50-85 g
Habitat : thin scrub & scrub at forest edges, often interspersed with cultivation
Altitude : unknown

Reproduction & Life Cycle

Call : *kirikkee, kirikkee, tu-tu-tu-tu-tutu-tutu-tuttu*
Breeding Season : Throughout
Nest Site/ Type : under rock, bush or grass tussock
Clutch Size : 4 to 7
Incubation Period: 16-18 days

Behaviour

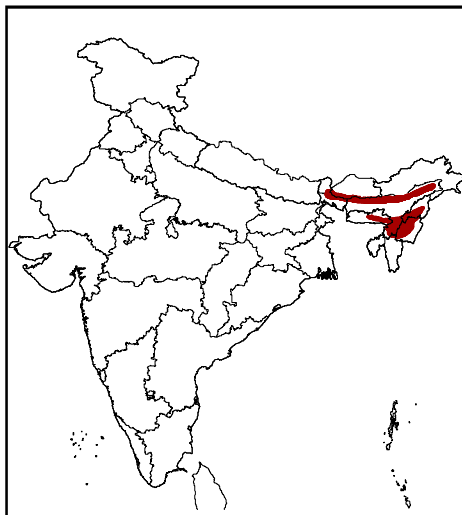
Similar to those of Jungle Bush Quail. Keeps in parties of up to 15 birds for most of the year. Feeds in open areas during mornings and evenings. Often dust bathes at edges of jungle paths and tracks. When flushed the party scatters in all directions, the birds tumbling into the undergrowth after a short flight. They begin their rally calls to each other almost at once, and soon work their way back through the bushes to reunite.

**MANIPUR BUSH QUAIL *Perdica manipurensis* Hume 1880**

Vernacular Names: *Kala goondri* (Assamese-Goalpara), *Lanz sorbol*, *Sorbol amuba* (Manipuri)



Daniel Cole

**Distribution and Habitat**

Very rare local resident, now confined to NE Indian states viz., Assam, Manipur, Meghalaya, Nagaland and West Bengal. Inhabits tall moist grassland and scrub habitats in foothills (up to 1,000 m), and also in swamps. Recently, rediscovered after a gap of 75 years in Manas NP¹.

Conservation Status

IUCN : vulnerable
IWPA : Schedule IV
CITES : not listed

Description

A dark but brightly coloured quail, with dark olive-grey upperparts finely marked with black barring and spotting, and golden-buff under parts with black cross-shaped markings. Male is distinguishable by white lores, and chestnut forehead, supercilium, lower ear-coverts and throat. Female has less 'golden' underparts, chestnut of head replaced by brownish-grey.

Size, Habitat & Altitude Range

Body Length : 20 cm
Weight : 64-78 g
Habitat : tall moist grassland & scrub in foothills, sometimes in swamps
Altitude : unknown

Reproduction & Life Cycle

Call : *whit-it-it-it- t-t*
Breeding Season : unknown
Nest Site/ Type : among grass
Clutch Size : 4
Incubation Period : unknown

Behaviour

Similar to those of Jungle bush Quail. Usually encountered in parties of six to eight birds. Very secretive and keeps in dense cover. Comes out into burnt grass patches with new shoots sprouting, in the early morning and late afternoon. When roosting or resting during the day, the birds bunch up together under a bush facing outward. When flushed, they burst into flight in all directions with a loud whirring of wings; they soon reassemble by making rallying calls to each other. Most easily located by its distinctive call.

¹Choudhury, A. 2006. Rediscovery of Manipur Bush Quail. *Mistnet*, 7(2):15-16.

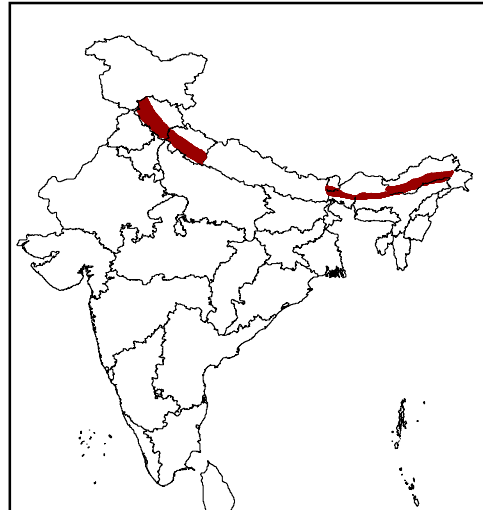


HILL PARTRIDGE *Arborophila torqueola* Valenciennes 1826

Vernacular Names: *Peura*, *Ban teetar* (Hindi, Garhwali, Kumauni), *Roli*, *Ram chukra* (Himachali), *Duboi* (Assamese-Nowgong), *Dao bui* (Assamese-Cachar), *Kohumbut* (Sikkim-Lepcha), *Pao-er* (Arunachal-Mishmi), *Wogam*, *Gam toung* (Mainpuri-Kachin), *Inrui whip* (Naga)



Carl D'Silva



Distribution & Habitat

Resident and fairly common in the Himalayas (1,830-3,050 m) from Himachal Pradesh east to Arunachal Pradesh and northeast India. Inhabits ravines and slopes in undergrowth of moist, dense oak and other evergreen broad-leaved forests.

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Description

A dumpy, short-tailed olive-brown partridge. Male has rufous crown and nape, black eye-patch and eye-stripe, white neck sides streaked with black, and white half-collar separating throat from breast. Female is similar to male, but has olive-brown crown and ear-coverts and rufous fore neck. Could be distinguished from Rufous-throated Partridge as male has rufous crown and presence of white half-collar separating throat from breast. Whereas, female closely resembles Rufous-throated and could be distinguished by buff supercilium, lack of black border between rufous fore neck and grayish breast, blackish barring to olive-brown mantle, diffuse rufous-buff fringes to breast, and grayish or brownish legs and feet.

Size, Habitat & Altitude Range

Body Length : 28 cm
Weight : 227-400 g
Habitat : ravines & slopes in undergrowth of moist dense forest of oak and other evergreen broadleaves
Altitude : 400-4,000 m

Reproduction & Life Cycle

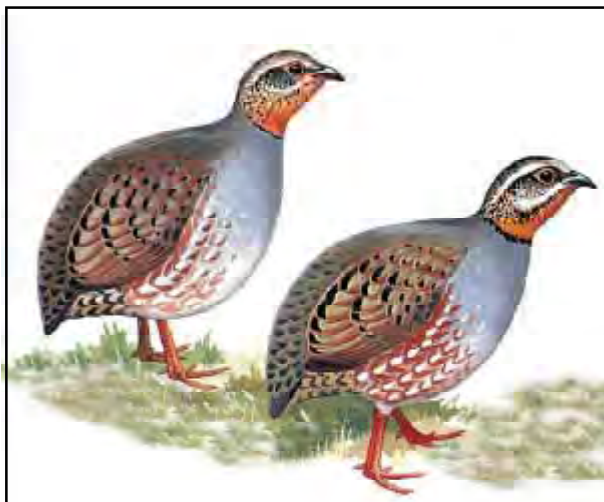
Call : whistle
Breeding Season : April-July
Nest Site/ Type : forest or scrub jungle
Clutch Size : 3 to 5
Incubation Period : unknown

Behaviour

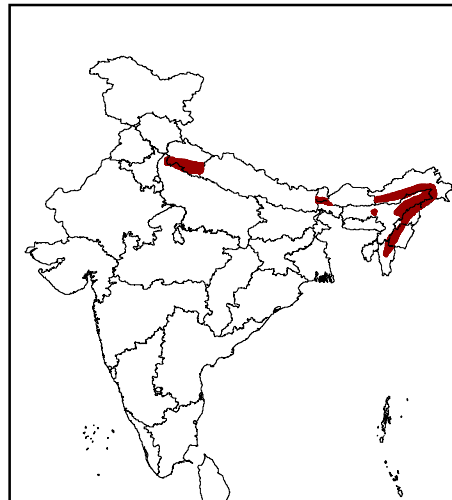
Usually in pairs but sometimes gregarious, found in parties of five to ten birds outside the breeding season. Dig for food among litter and humus on the forest floor, and birds keeping in contact by calling, as they move in forest. When disturbed, usually moves away on foot; if flushed, flies strongly, zigzagging around the trees, and usually settles after less than 100 m. Roost in parties on trees. Call is a single, mournful, drawn-out whistle, repeated 2 or 3 times, followed by 3 to 6 double whistles.

**RUFIOUS-THROATED PARTRIDGE** *Arborophila rufogularis* Blyth 1850

Vernacular Names: *Peura* (Hindi, Kumauni), *Duboi* (Assamese-Nowgong), *Daobui Daobui yegashi* (Assamese-Cachar), *Kohumbut* (Sikkim-Lepcha), *Pokhu* (Arunachal-Dafla), *Inrui whip* (Naga)



Carl D'Silva

**Distribution & Habitat**

Resident and locally fairly common, in the Himalayas (460-2,500 m) from Uttarakhand east to Arunachal Pradesh and in the hills of northeast India. Subject to vertical movements, *i.e.*, 1,450-1,830 m in the Himalayas and 600-1,800 m in the hills of northeast India. Generally at lower altitudes than Hill Partridge, although ranges sometimes overlap. Inhabits thick understorey of broadleaved evergreen forest and secondary growth.

Description

As like the Hill Partridge, it is a dumpy short-tailed olive-brown partridge. The male is distinguished from the Hill Partridge by grayish forehead and olive-brown crown, rufous-orange throat and fore neck spotted with black, and lack of white half-collar. Both sexes more closely resemble the female Hill Partridge, and are distinguished by the greyish-white supercilium, white moustachial stripe eye, narrow black band between rufous-orange fore neck and grey breast, uniform olive-brown mantle, darker grey breast, and pinkish-red legs and feet.

Behaviour

Similar to Hill Partridge, usually in pairs but sometimes gregarious, found in parties of six to twelve birds outside the breeding season. Usually not shy, but skulk under dense undergrowth and difficult to flush. Dig for food among litter and humus on the forest floor, and birds keeping in contact by calling, as they move in forest. When disturbed, usually moves away on foot; if flushed, flies strongly, zigzagging around the trees, and usually settles after less than 100 m. While in flight in open areas, it deceptively appears like a female kaleej pheasant, but as small as a quail while in dense undergrowth. Roost in conveys on trees. Call is a mournful double whistle repeated constantly and onslightly ascending scale.

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Size, Habitat & Altitude Range

Body Length : 27 cm
Weight : 200-370 g
Habitat : thick understorey of broadleaved evergreen forest and secondary growth
Altitude : 460-2,500 m

Reproduction & Life Cycle

Call : wheea-whu
Breeding Season : April-August
Nest Site/ Type : thick pad or hidden in grass or dense undergrowth
Clutch Size : 4 to 5
Incubation Period: unknown



WHITE-CHEEKED PARTRIDGE *Arborophila atrogularis* Blyth 1850

Vernacular Names: *Peura* (Hindi), *Duboi*, *Dubore* (Assamese), *Dao bui*, *Daobui yegashi* (Assamese-Cachar), *Inrui whip* (Naga)



Carl D'Silva



Distribution & Habitat

Resident and fairly common (in areas <750m) in Eastern Himalayas and northeast India (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Tripura) from the lower foothills up to 1500 m. Inhabits bamboo thickets and damp undergrowth in less dense broadleaved evergreen forest than those inhabited by Hill or Rufous-throated Partridges.

Conservation Status

IUCN : near threatened
IWPA : Schedule IV
CITES : not listed

Description

A dumpy short-tailed olive-brown forest partridge. It is distinguished from other partridges belonging to this genus in the region by white patch on ear-coverts and whitish supercilium, black mask and throat black-streaked orange-yellow on hind neck and sides, and black streaking on white fore neck. Legs and feet are yellowish to red. Mantle and back are olive-brown and heavily striped with black, and upperparts are very similar to female Hill Partridge, although hind neck is orange-yellow.

Size, Habitat & Altitude Range

Body Length : 28 cm
Weight : 200-312g
Habitat : bamboo thickets & damp undergrowth in less dense broadleaved evergreen forest
Altitude : <1,500 m

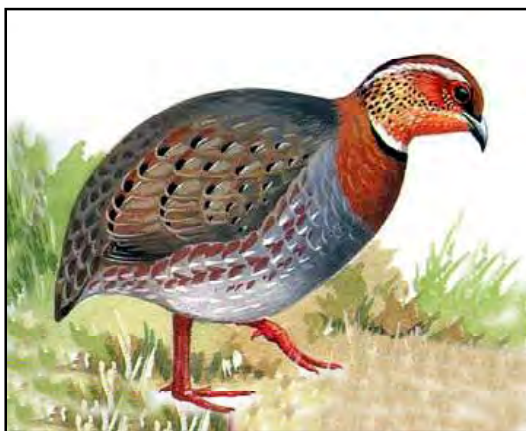
Behaviour

Like those of Hill Partridge. Usually in pairs but sometimes gregarious, found in coveys of five to eight birds outside the breeding season. Dig for food among litter and humus on the forest floor, and birds keeping in contact by calling, as they move in forest.

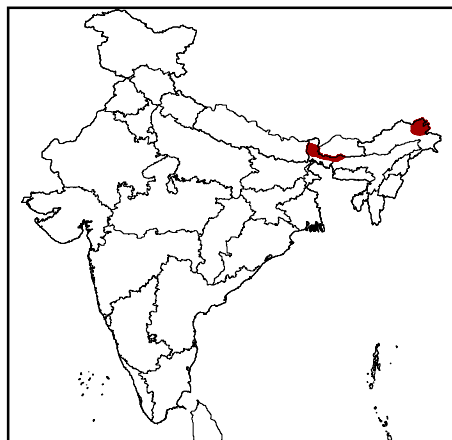
When disturbed, usually moves away on foot; if flushed, flies one at a time and only when underfoot, thereby, giving a false impression of being solitary birds. Flies strongly, zigzagging around the trees, and usually settles after less than 100 m. Roost in coveys on trees. Call is accelerating and ascending series of 12-18 far-carrying, throaty 'whew' notes that end abruptly.

Reproduction & Life Cycle

Call : *whew..whew..whew*
Breeding Season : March-July
Nest Site/ Type : hollow filled with leaves or a thick pad of grass with a dome
Clutch Size : 4 to 5
Incubation Period: unknown

**CHESTNUT-BREASTED PARTRIDGE** *Arborophila mandellii* Hume 1874**Vernacular Names:** *Pao-er* (Arunachal-Mishmi)

Carl D'Silva

**Distribution & Habitat**

Resident and uncommon in eastern Himalayas from West Bengal east to Arunachal Pradesh and Assam between 350 and 2,500 m and possibly higher. Inhabits dense undergrowth in broadleaved evergreen forest.

Conservation Status

IUCN : vulnerable
IWPA : Schedule IV
CITES : not listed

Description

A typically dumpy hill partridge. It is distinguishable from other partridges belonging to the same genus by the presence of white half-collar and broad chestnut breast-band. It also has rufous-orange ear-coverts, throat and foreneck, black division between orange foreneck and chestnut breast, black spotting on ear-coverts and sides of neck, and grayish supercilium. Lower breast to vent grey marked on flanks with chestnut and white. Under tail-coverts olive with white spots and rufous mottling. Sexes similar.

Size, Habitat & Altitude Range

Body Length : 28 cm
Weight : unknown
Habitat : dense undergrowth in broadleaved evergreen forest
Altitude : 350-2,500 m

Behaviour

Unknown in the wild. The call starts with repetition of *prreet*, followed by a series of ascending double notes leading to a climax.

Reproduction & Life Cycle

Call : *prreet..prreet.., prrr prrr-er-it*
Breeding Season : unknown
Nest Site/ Type : pad of grass under a rock in forest
Clutch Size : unknown
Incubation Period : unknown

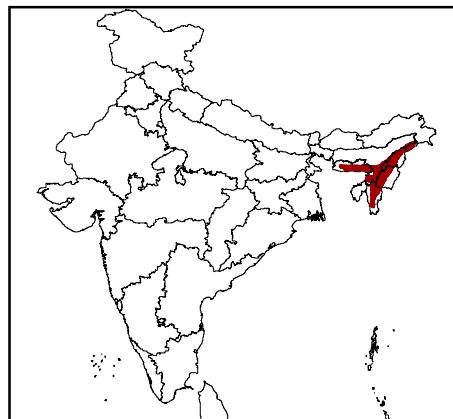


MOUNTAIN BAMBOO PARTRIDGE *Bambusicola fytchii* Anderson 1871

Vernacular Names: *Dao bui lai* (Assamese-Cachar); *Wakrek* (Manipuri)



Daniel Cole



Distribution & Habitat

Resident, but rare. Distributed in northeast India (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland) mostly at low altitudes, but sometimes up to 2,000 m. Inhabits open scrub jungles mixed with tall grasslands along stream banks, paddy fields and dense grass in foothills and sometimes in the adjacent plains. In Manipur, it occurs in low oak and willow scrub along banks of streams, mixed with tall grass and *Rubus* scrub. It favours patches of *Alpinia*, a wild cardamom-like plant.

Conservation Status

IUCN : others
IWPA : Schedule I
CITES : not listed

Size, Habitat & Altitude Range

Body Length : 35 cm
Weight : 285-400 g
Habitat : dense grass in foothills and sometimes adjacent plains, scrub bordering in dense grass or in trees
Altitude : <2,000 m

Description

A comparatively long-tailed rufous brown partridge with broad, buffish-white supercilium and dark eye-stripe, warm buff ear-coverts, throat and foreneck, rufous and chestnut spotting on breast, mantle and scapulars, diffusely striped tail, and bold blackish heart-shaped spots on flanks. During flight, the rufous primaries and sides of tail are visible. Sexes similar.

Reproduction & Life Cycle

Call : kar-kar, kee, ke-kee
Breeding Season : March-May
Nest Site/ Type : under shrub or tree or in grass clump
Clutch Size : 4 to 6
Incubation Period: 18-19 days

Behaviour

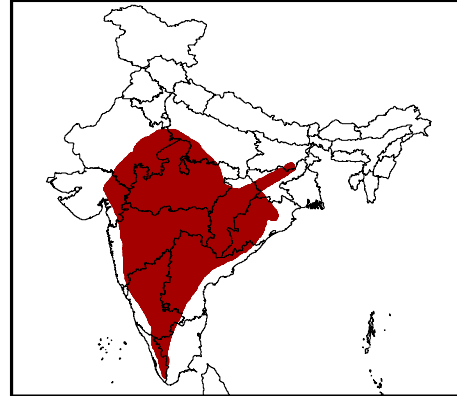
Usually found in parties of up to five or six birds outside the breeding season. Generally shy, coming out in the open to feed only in early mornings and evening, but seldom straying far away from water. Males are very noisy in spring, flying up frequently with a flutter of wings to a nearby mound or tree stump and crowing challenges two or three times and then dropping to the ground. Difficult to flush, and then flies rapidly a short distance before landing in dense grass or in trees. The call is similar to Black Francolin but less shrill and high pitched.

**RED SPURFOWL *Galloperdix spadicea* Gmelin 1789**

Vernacular Names: *Chhoti jangli murghi* (Hindi-Madhya Pradesh), *Sarawa kozhi*, *Chakutti kozhi* (Tamil), *Mullan kozhi* (Malayalam), *Yerra kodi*, *Jita kodi* (Telugu), *chakotri*, *Koaktri*, *Kastoor* (Marathi), *Chokara* (Gujarati)



Daniel Cole

**Distribution & Habitat**

Resident, widespread and fairly common. Distributed from Uttar Pradesh south through the peninsula; foothills up to 1,250 m. Inhabits dense scrub near cultivation, dry and stony scrub-covered foothills, bamboo thickets and secondary growth. In southern India, it inhabits coffee estates, lantana patches, and even near villages.

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Description

A reddish-brown partridge-like bird with a comparatively long tail, that is held partly fanned and with central ridge. It has red base to bill and eye-patch, and reddish legs and feet. Male has brownish-grey head and neck and darker brown crown, reddish-brown above, scaled with grey and buff below, brownish-black unbarred tail. Female has browner head and neck, buffish-brown above with bold blackish markings, reddish-brown below with irregular blackish stripes, and buff stripes on tail.

Size, Habitat & Altitude Range

Body Length : 36 cm
Weight : 148-454 g
Habitat : dense scrub near cultivation, dry & stony scrub-covered foothills, bamboo thickets and secondary growth
Altitude : <1,250 m

Behaviour

Found in pairs or in parties of three to five birds in scrub vegetation. It is shy, wary, and a great skulker which is more often heard than seen. It is very fast on legs and generally runs uphill and flushes only when hard pressed. It seldom flies far and usually only to 'hedge-hop', thus placing more thickets between itself and the observer and continuing to run again as soon as it touches down, tail open fanwise and carried partly erect. Roosts and often takes refuge in trees or dense thorny bushes. It feeds by scratching about among dead leaves under scrub and coming into the open areas and edges in early mornings or evenings. The call is similar to male Junglefowl.

Reproduction & Life Cycle

Call : ku-ruk-ku-rak, kuk-kuk-ku-tuk
Breeding Season : January-June
Nest Site/ Type : dense scrub or bamboo
Clutch Size : 3 to 5
Incubation Period : unknown

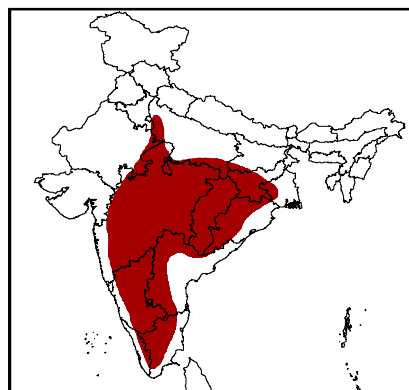


PAINTED SPURFOWL *Galloperdix lunulata* Valenciennes 1825

Vernacular Names: *Kalkodi* (Tamil), *Jitta kodi* (Telegu), *Askal, Kainjer* (Oriya), *Hutka* (Gondi)



Daniel Cole



Distribution & Habitat

Resident and fairly common. Distributed from east Rajasthan eastwards to West Bengal and south through the peninsula in foothills up to 1,000 m. Its range overlaps with that of Red Spurfowl but generally in drier, rockier country than Red spurfowl. Inhabits dry stony foothills covered with dense thorn scrub or bamboo thickets.

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Description

A partridge-like bird distinguished by longer tail and distinctive colouration. Male has greenish-black head and neck spotted and barred with white, chestnut-red above with black-bordered white

Size, Habitat & Altitude Range

Body Length : 32 cm
Weight : 138-161 g
Habitat : dense thorn scrub or bamboo thickets in dry stony foothills
Altitude : unknown

spots, greenish-black wings and tail with white spotting on coverts. It has yellowish-buff breast and belly barred and spotted with black, and chestnut flanks. Female could be distinguished from female Red Spurfowl by dark olive-brown upperparts and breast, buff throat and malar stripe, and chestnut forehead, supercilium and ear-coverts. Lacks red orbital skin, and has dark bill and legs.

Behaviour

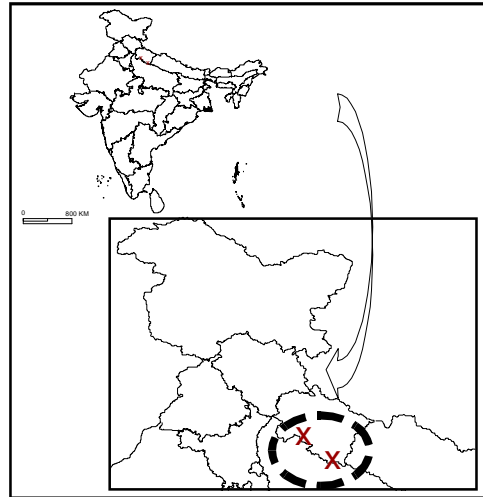
Usually seen in pairs or in family parties of up to five birds. Is a greater skulker than Red Spurfowl. If disturbed, runs away swiftly. If disturbed further, it will fly a few metres, then land and run on again or hide in crevices and escapes into holes among rocks. Male when flushed utters 'a curious bubbling, half-scolding clucking note'.

Reproduction & Life Cycle

Call : *chur, chur, chur*
Breeding Season : January-June
Nest Site/ Type : under rocks or vegetation
Clutch Size : 3 to 4
Incubation Period : unknown

**HIMALAYAN QUAIL *Ophrysia superciliosa* J.E. Gray 1846****Vernacular Names:** *Chota kala teetar* (Hindi)

Daniel Cole

**Distribution & Habitat**

Former status unknown, occurred in W Himalayas in Uttarakhand, at 1,650-2,100 m; now presumed extinct, last confirmed sighting in 1890, but may still be surviving. Old records are from Jharipani, Banog and Bhadraj (near Mussorie) and Sher-ka-danda (near Nainital). Reported to occur in long grass and brushwood on steep hillsides.

Conservation Status**IUCN** : critically endangered**IWPA** : Schedule I**CITES** : not listed**Description**

A relatively small, long-tailed slaty brown galliforme with red bill and legs. Male has a complex black-and-white head pattern with black-bordered grayish-white supercilium, grayish-white eye-patch and patch on ear-coverts, and black throat with grayish-white border. The above and below are dark slaty olive-brown with black streaks, except for under tail-coverts, which are black with grayish-white barring. Female does not have striking head pattern like male, but with narrow white eye-patch, pale vinaceous-grey supercilium and ear-coverts, and black sides of crown and stripe behind eye. Above are cinnamon-brown and marked with black; below pale vinaceous-brown, streaked with black

Size, Habitat & Altitude Range**Body Length** : 25 cm**Weight** : unknown**Habitat** : long grass and brushwood
on steep hill sides**Altitude** : 1,650-2,100 m**Reproduction & Life Cycle****Call** : A shrill whistle when
disturbed**Breeding Season** : unknown**Nest Site/ Type** : unknown**Clutch Size** : unknown**Incubation Period** : unknown**Behaviour**

Historical records indicate that it was usually seen in pairs or in parties of three to six. Being greater skulker, it rarely flushed from thick cover. If flushed, birds flew slowly and heavily, soon dropped into vegetation, and reunited by using shrill whistles.





3.0 Pheasants

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Seventeen species of Pheasants occur in India (see Table). In this Chapter, we present the Species Accounts for these species in a field guide format that would provide information at a glance. We have collated information largely from Ali and Ripley (1983), Johnsgard (1985), McGowan and Garson (1995), Grimmett, Inskipp and Inskipp (1998), and Madge and McGowan (2002). Other works that were consulted are given in the References below. We have followed Monroe and Sibley (1993) for taxonomic sequence, and Inskipp, Lindsey and Duckworth (1996) for common names. For currently valid scientific names, we have followed emendations as and when adopted by the British Ornithologists Union, Clements checklist (2004), Howard and Moore's checklist (Dickinson 2003), Oriental Bird Club checklist by Inskipp *et al.* (1996), Allan Peterson's zoonomen database and other taxonomy publications in peer reviewed journals. Species illustrations are from the book "Pheasants, Partridges and Grouse" by Madge and McGowan (2002), A and C Black (Publishers) Ltd., London.

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Pheasants of India

S.No.	COMMON NAME	SCIENTIFIC NAME
1	Blood Pheasant	<i>Ithaginis cruentus</i>
2	Western Tragopan	<i>Tragopan melanocephalus</i>
3	Satyr Tragopan	<i>Tragopan satyra</i>
4	Blyth's Tragopan	<i>Tragopan blythii</i>
5	Temminck's Tragopan	<i>Tragopan temminckii</i>
6	Koklass Pheasant	<i>Pucrasia macrolopha</i>
7	Himalayan Monal	<i>Lophophorus impejanus</i>
8	Sclater's Monal	<i>Lophophorus sclateri</i>
9	Red Junglefowl	<i>Gallus gallus</i>
10	Grey Junglefowl	<i>Gallus sonneratii</i>
11	Kalij Pheasant	<i>Lophura leucomelanos</i>
12	Tibetan Eared Pheasant	<i>Crossoptilon harmani</i>
13	Cheer Pheasant	<i>Catreus wallichii</i>
14	Mrs Hume's Pheasant	<i>Syrnaticus humiae</i>
15	Grey Peacock Pheasant	<i>Polyplectron bicalcaratum</i>
16	Indian Peafowl	<i>Pavo cristatus</i>
17	Green Peafowl	<i>Pavo muticus</i>

**BLOOD PHEASANT** *Ithaginis cruentus* Hardwicke 1821

Vernacular Names: *Same, Semo, Soomoong pho* (Sikkim-Lepcha), *Chiku* (Arunachal-Mishmi)



David Mead

**Distribution & Habitat**

Resident and fairly common. Distributed in the Central and Eastern Himalayas (Sikkim & Arunachal Pradesh), mostly between 3,200-4,700 m (down to 1,500 m in winter). Inhabits open fir and rhododendron forest and rhododendron scrub, birch and juniper scrub. Mostly in dense bamboo clumps and often near snow patches.

Conservation Status

IUCN : others
IWPA : Schedule I
CITES : II

Description

Male is an unmistakable brightly coloured pheasant with lanceolate plumage. It has bright red orbital patch; black forehead and 'spectacles'; crimson-red chin and throat; blue-grey upperparts streaked with white (and with apple-green in wing-coverts); apple-green underparts streaked with pale yellow-green; and crimson splashes on breast, tail-coverts and in tail. The female has dark brown upperparts, and rufous-brown underparts. It has grey crest, nape and upper mantle, and rufous-orange forehead, face and throat.

Behaviour

When compared to other pheasants, the Blood Pheasant is found at higher elevations, even in winter. It is gregarious and keeps in coveys of five to ten birds, but sometimes 30 or more. Tame and fearless, it is a swift and strong runner and usually runs uphill or flies down hill. It forages actively throughout the day, scratching the ground and turning over leaves and grasses with its feet; can dig down through snow, which often covers the vegetation. It roosts in trees or scrub, or on the ground. The call is a repeated *chuck*, and has a loud, grating *kzeuuk-cheeu-chee*.

Size, Habitat & Altitude Range

Body Length : 38 cm

Weight : 482-568 g

Habitat : open fir and rhododendron forest, shrubberies of rhododendron, juniper & birch, partial to dense bamboo clumps

Altitude (m) : 1,500-4,700 m

Reproduction & Life Cycle

Call : *chuck*,
kzeuuk-cheeu-cheeu-cheeu

Breeding Season : April-June

Nest Site/ Type : loose nest of leaves under bushes or bamboo

Clutch Size : 5 to 12

Incubation Period : 29 days

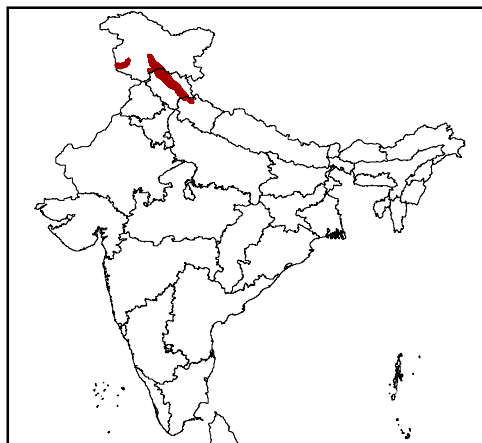


WESTERN TRAGOPAN *Tragopan melanocephalus* Gray 1829

Vernacular Names: *Jujurana* (Himachali-Kullu, Mandi), *Fulgar*, *Fulgari* (Himachali-Chamba), *Pyara* (Kinnaur), *Jyazi* (Bushahr) *Sonalu*, *Solalee* (Kashmiri), *Jewar* (Garhwali), *Sing monal* (Pahari-N.W.Himalaya)



David Mead



Distribution & Habitat

Resident and rare. Distributed in the northwestern and western Himalayas (Jammu & Kashmir, Himachal Pradesh and Uttarakhand), mostly between 2,400-3,600 m (down to 2,000 m in winter). Inhabits dense undergrowth and montane bamboo clumps in undisturbed temperate and subalpine oak, coniferous, and mixed forests.

Conservation Status

IUCN : vulnerable
IWPA : Schedule I
CITES : I

Description

A brightly coloured, white-spotted, red and black pheasant. The male is strikingly different from male Satyr Tragopan, by having bright orange foreneck and upper breast, white-spotted black underparts, and deep scarlet hindneck contrasting with intricately patterned black and grey-brown upperparts. It also has red facial skin, bluish throat, and bluish lappets and horns which are erected in display. The female is dull grayish-brown in colour, intricately patterned with dark browns, greys and buffs. It has slight rufescent tinge to crown and neck, and irregular white spotting on underparts. Very similar to female Satyr Tragopan, but has dark grey-brown coloration to underparts. When in flight, it could be confused with females of Koklass pheasant and Himalayan Monal. The former has broad, rounded tail and stockier appearance, darker and more uniform coloration, and lack of white on throat. The latter is heavily streaked on upperparts and underparts, has white throat and 'horseshoe' patch on rump, and has a loud shrieking flight call.

Size, Habitat & Altitude Range

Body Length : 68-73 cm
Weight : 1,250-2,150 g
Habitat : dense undergrowth in undisturbed temperate and subalpine oak, coniferous and mixed forests
Altitude : 1,735-3,600 m

Behaviour

Usually found singly or in pairs. It is very shy, extremely wary and skulking, but sometimes forages in forest glades or on open slopes. Feeds on the ground, mainly in early mornings and late evenings. It roosts in trees, where it is well concealed. Territorial during breeding season. While displaying, males repeatedly expand and contract their horns and colorfully patterned lappets. The call is a nasal, wailing *khuwaaah*, repeated in bouts of 7-15 calls, uttered by male and female, usually at dawn and dusk, and is very similar to the wailing of a child or goat. When alarmed, a more abrupt and anxious *waa, waa, waa*.

Reproduction & Life Cycle

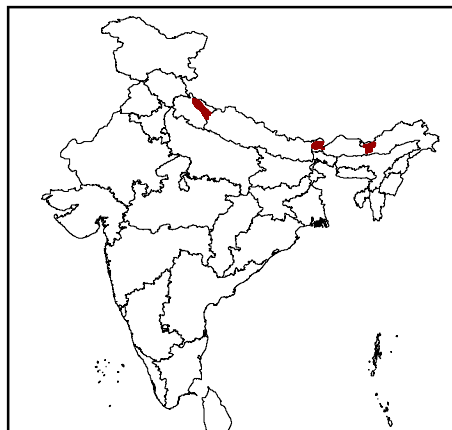
Call : *khuwaaah, khuwaaah, waa, waa, waa*
Breeding Season : May-early June
Nest Site/ Type : nest of sticks, line with grass, in thick undergrowth
Clutch Size : 3 to 6
Incubation Period: 28 days

**SATYR TRAGOPAN *Tragopan satyra* Linnaeus 1829**

Vernacular Names: *Lungi* (Hindi, Garhwali, Kumauni), *Bop* (Bhotia), *Tarrhyak* (Sikkim-Lepcha)



David Mead

**Distribution & Habitat**

Resident and rare. Distributed in the western, central and eastern Himalayas (eastern Uttarakhand, northern West Bengal, Sikkim and western Arunachal Pradesh), mostly between 2,400-4,500 m (down to 2,000 m in winter). Inhabits dense undergrowth or montane bamboo clumps in temperate and subalpine oak-rhododendron, coniferous or broadleaved forests, scrub in steep hillsides, and narrow ravines.

Conservation Status

IUCN : near threatened

IWPA : Schedule I

CITES : III

Description

Male is a brightly coloured unmistakable pheasant. It has red neck, mantle and underparts that are black-bordered white spots. It has intricately patterned olive-brown back, rump, uppertail-coverts and wing coverts, spotted with white and mottled with red. It also has blue facial skin and throat, and bluish lappets and horns which are erected in display. The female varies from rufous-brown to ochraceous-brown in colour, and is vermiculated, mottled and spotted with black and buff. As like other female tragopans, the underparts are generally brighter and more rufescent

Size, Habitat & Altitude Range

Body Length : 67-72 cm

Weight : 1,000-2,100 g

Habitat : moist oak & rhododendron forest with dense undergrowth and bamboo clumps, shrubberies on steep hill sides, narrow ravines, & mixed coniferous/ broadleaved forest

Altitude : 2,000-3,800 m

Behaviour

Similar to those of Western Tragopan. Usually found singly or in pairs. It is very shy, extremely wary and skulking, but sometimes forages in forest glades or on open slopes. Feeds on the ground, mainly in early mornings and late evenings. Roosts in trees, where it is well concealed. Territorial during the breeding season. While displaying, males repeatedly expand and contract their horns and colorfully patterned lappets. It gives a deep, wailing drawn-out call, mainly at dawn, *wah, waah! Oo-oh! Oo-aaaa!* uttered 12-14 times, the series rising in volume and becoming more protracted until it becomes almost a shriek. Also a *wah, wah* call uttered at any time of the day. When alarmed, or flushed, a more anxious *wak, wak* call.

Reproduction & Life Cycle

Call : *wah, waah! oo-aaaa! , wah, wah, wak, wak, wak, wak*

Breeding Season : May-June

Nest Site/ Type : a rough nest of sticks in branches of a forest tree

Clutch Size : 2 to 4

Incubation Period : unknown

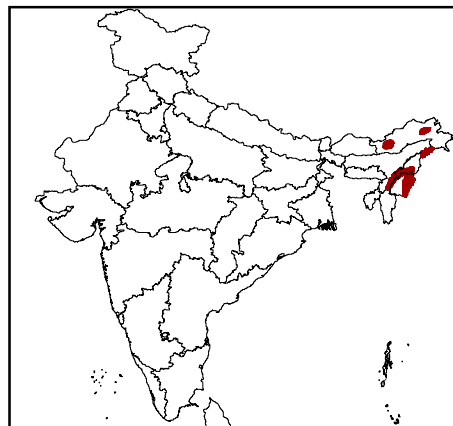


BLYTH'S TRAGOPAN *Ttragopan blythii* Jerdon 1870

Vernacular Names: *Son sorai* (Assamese-Sadiya), *Hur huria* (Assamese & Miri), *Gnu* (Naga-Angami), *Aghah* (Naga-Sema), *Aoho* (Naga-Chang)



David Mead



Distribution & Habitat

Resident and rare. Distributed in the eastern Himalaya (Arunachal Pradesh) and hills of northeast India (Assam, Manipur, Mizoram and Nagaland). Inhabits moist, evergreen broad-leaved forest with a thick understorey, dense scrub, and in montane bamboo on steep slopes.

Conservation Status

IUCN : vulnerable
IWPA : Schedule I
CITES : I

Description

The male is large brightly coloured pheasant with brilliant red plumage and conspicuous white ocelli on back. The male is similar to Satyr and Temminck's Tragopans, but has sandy-grey breast and belly and orange-yellow facial skin. It also has broader red supercilium, and has clean division between red of hindneck and 'brown' upperparts, which have numerous brownish-maroon ocelli. Female could be distinguished from female Satyr Tragopan by paler underparts lacking strong rufous tone, and from female Temminck's by paler underparts with much less distinct white spotting.

Size, Habitat & Altitude Range

Body Length : 65-70 cm
Weight : unknown
Habitat : moist, evergreen broadleaved forest with a thick under storey; dense shrubberies & montane bamboo on steep slopes
Altitude : 1,800-3,500 m

Behaviour

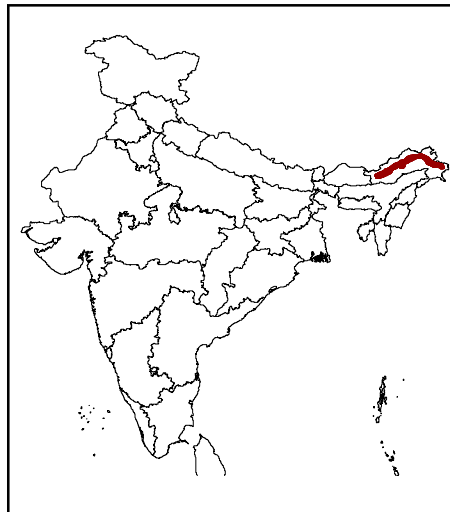
Similar to those of Western Tragopan. Usually found singly or in pairs or in small parties of four to five. It is very shy, extremely wary and skulking, but sometimes forages in forest glades or on open slopes. Feeds on the ground, mainly in early mornings and late evenings. It roosts in trees, where it is well concealed. Territorial during the breeding season. While displaying, males repeatedly expand and contract their horns and colorfully patterned lappets. The call is a deep *mao, mao* uttered in the early morning and again in the evening. Male's courtship call is a sonorous *wak*, sometimes lengthened to a *wa ak-ak* producing a 'two-toned' effect.

Reproduction & Life Cycle

Call : *mao, mao*,
wak, wa ak-ak
Breeding Season : poorly known
Nest Site/ Type : unknown
Clutch Size : unknown
Incubation Period : unknown

**TEMMINCK'S TRAGOPAN** *Tragopan temminckii* Gray 1831**Vernacular Names:** *Bop* (Tibetan)

David Mead

**Distribution & Habitat**

Resident and rare. Distributed in eastern Himalaya (Arunachal Pradesh) between 2,100-3,600 m. Inhabits dense undergrowth in damp, evergreen broad-leaved forest and dense rhododendron and montane bamboo.

Conservation Status

IUCN : others
IWPA : Schedule I
CITES : not listed

Description

The male is large bright crimson coloured pheasant with round black-bordered pearl-grey spots or ocelli on underparts. Male distinguished from male Satyr Tragopan by larger spotting (without black borders), brighter orange red neck, mainly red upperparts (lacking Satyr's olive-brown tones to back and rump) with black-bordered grayish-white spotting, and more extensive blue facial skin. It could be easily distinguished from male Blyth's Tragopan by coloration and patterning of upperparts and underparts. The female is much more conspicuously spotted with white on underparts than other female tragopans.

Size, Habitat & Altitude Range

Body Length : 64 cm
Weight : 1,600 g
Habitat : dense undergrowth in damp, evergreen broadleaved forest and dense rhododendron & bamboo
Altitude : 2,100-3,600 m

Behaviour

Similar to those of other Tragopans, but very arboreal. Usually found singly or in pairs. It is very shy, extremely wary and skulking, but sometimes forages in forest glades or on open slopes. Feeds on the ground, mainly in early mornings and late evenings. It roosts in trees, where it is well concealed. Territorial during breeding season. While displaying, males repeatedly expand and contract their horns and colorfully patterned lappets. The call is a series of six to nine eerie moaning notes, gradually increasing in length and volume, terminated by a curious nasal grumbling note *oh...woah..woah... waaah..waaah.. waaah..waaah.. griiik*

Reproduction & Life Cycle

Call : *who..woah..woah..woahh.. waaah..waaah..waaah..griiik*
Breeding Season : poorly known
Nest Site/ Type : unknown
Clutch Size : unknown
Incubation Period : unknown



KOKLASS PHEASANT *Pucrasia macrolopha* Lesson 1829

Vernacular Names: *Pucrasi* (Kumauni), *Pucklas* (Garhwali, Himachali), *Kukrola* (Himachali-Chamba), *Plash*, *Khwasksha* (Shimla/ Pandrabis), *Plas* (Kashmiri)



Carl D'Silva



Distribution & Habitat

Resident and fairly common. Distributed in the north western and western Himalayas (Jammu & Kashmir, Himachal Pradesh, Uttarakhand) between 2,700 and 3,300 m (down to 1,500m in winters). Inhabits coniferous, oak and deodar forests with dense undergrowth of bushes and montane bamboo, and favours steep slopes and ravines.

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Description

The male is a medium-tailed Himalayan pheasant with distinct metallic green head and hornlike ear-tufts, yellowish-brown crest, white neck patch, streaked appearance to body, and variable amounts of chestnut on breast and belly. The female has white throat and short buff ear-tufts; upperparts are mottled black and brown, and finely streaked with buff, and buffish underparts (prominently streaked with black). It is likely to be confused with female Kalij Pheasant but that species has bared red facial skin, more uniform brownish upperparts, and a laterally compressed tail. When in flight, it could be distinguished from female tragopans by white throat, smaller size and 'streaked' appearance, and by longer, more sharply graduated tail.

Size, Habitat & Altitude Range

Body Length : 58-64 cm
Weight : 510-1,415 g
Habitat : coniferous, oak & deodar forests with dense undergrowth of bushes & montane bamboo
Altitude : 2,100-3,300 m

Behaviour

It usually occurs singly or in pairs, but in winter, several birds may congregate. It is very shy and secretive and more often heard (dawn) than seen. When disturbed, it runs away quickly through undergrowth, or bursts upwards giving a noisy alarm before flying down the slope, twisting between the trees at great speed. Feeds mainly in dawn and dusk in grassy glades. It roosts in trees, from where males crow at dawn almost throughout the year. It is highly territorial during the breeding season. The call is a *kok, kark, kuk..kukuk*, uttered mainly at dawn and repeated at intervals with corvid-like raucousness. When flushed, a harsh *Kwak-kwak-kwak*. Female's alarm call has been described as a higher-pitched, more melodic *quiquik qui-quik qui-quik*.

Reproduction & Life Cycle

Call : *kok..kark..kuk..kukuk, kwak-kwak-kwak*
Breeding Season : April-June
Nest Site/ Type : under thick bushes
Clutch Size : 5 to 7
Incubation Period : 20-21 days

**HIMALAYAN MONAL *Lophophorus impejanus* Latham 1790**

Vernacular Names: *Munal, Ghar munal, Ratia kawan, Ratnal, Ratkap, Nil(m), Kareri (f), Nilgur (Pahri-N.W.Himalaya), Bnal (m), Bodh (f), (Shimla, Kullu, Pandrabis), Datiya (Garhawali, Kumauni), Sunal, Sunamurgh(m), Ham(f) (Kashmiri), Fo dong (Sikkim-Lepcha), Pia padir (Arunachal-Mishmi)*



Kim Franklin

**Distribution & Habitat**

Resident and fairly common. Distributed in the north western, western, central and eastern Himalayas (Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim & Arunachal Pradesh) between 2,300-4,875 m and down to 2,000 m during winters (western Himalaya), and between 2,800-4,575 m and down to 2,500 m during winters (eastern Himalaya). Inhabits Temperate and subalpine oak, deodar, coniferous and rhododendron forests with montane bamboo and grassy glades; and alpine scrub and meadows, and sometimes remains above the snowline.

Conservation Status

IUCN : others
IWPA : Schedule I
CITES : I

Description

The male is a stout dumpy very colourful Himalayan pheasant that is unmistakable throughout much of its range. It has metallic green head and spatulate-tipped wire-like crest, brilliant metallic green and bronze on hindneck and mantle, iridescent blue and purple and green on wings and uppertail-coverts, cinnamon-brown tail, and velvety-black underparts. During flight, it exhibits white on back. The female has prominent white throat, short crest, and bright blue orbit skin. It has dark brown upperparts with streaked appearance, and brown underparts with variable, broad pale streaking. During flight, it shows whitish 'horse-shoe' on uppertail-coverts, and broad rounded tail with rufous barring and narrow white tip.

Size, Habitat & Altitude Range

Body Length : 70 cm
Weight : 1,800-2,380 g
Habitat : oak, coniferous, deodar & rhododendron forests with grassy glades, alpine meadows, rock & scrub
Altitude : 2,000-4,875 m

Behaviour

Usually occurs singly or in pairs and in small groups of three to four even in the breeding season. During late autumn and winter, it is gregarious and encountered in fairly large numbers in one place. It feeds mainly by digging with its strong bill, even when snow covered. Although cautious, it is less shy than most other Himalayan pheasants and can often be seen in summer foraging in pastures and flushing out even when disturbed at greater distances. It has a distinctive call, uttered by both sexes during the breeding season, is a series of upward-inflected whistles, *Kurleiu* or *kleeh-vick*, which are strung together, alternated with higher-pitched *kleeh* calls, similar to those of snowcocks. The alarm call is a similar *Kleeh-wick-kleeh-wick*, alternating with shorter, more urgent *kwick-kwick* cries.

Reproduction & Life Cycle

Call : *kur-leiu* or *kleeh-vick*
Breeding Season : April-mid July
Nest Site/ Type : on ground under a steep, rocky & grass covered slopes
Clutch Size : 4 to 6
Incubation Period : unknown

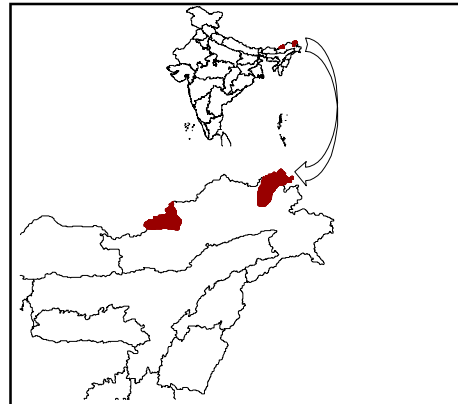


SCLATER'S MONAL *Lophophorus sclateri* Jerdon 1870

Vernacular Names: *Tratta*, *Poa padio* (Arunachal-Mishmi), *Pur di* (Arunachal-Chuikatta Mishmi)



Kim Franklin



Distribution & Habitat

Resident and rare. Distributed in the eastern Himalayas (Arunachal Pradesh) between 3,000 and 4,000 m. Inhabits fir forest with dense rhododendron undergrowth.

Conservation Status

IUCN : vulnerable

IWPA : Schedule I

CITES : I

Description

Male is similar to Himalayan Monal but somewhat duller and less refulgent metallic green, blue and bronze coloration to head and upperparts, and velvety-black underparts. It is distinguished from Himalayan Monal by lack of spatulate-tipped crest but has short curly crown feathers, by white lower back, rump and uppertail-coverts, and by broad white tip to the cinnamon-brown tail. Female is similar to female Himalayan Monal, but lacks crest and has contrastingly pale lower back, rump and uppertail-coverts, and broad white terminal band to tail. The upperparts and mantle are darker, and underparts are more uniform and lack bold splashes of grayish-white. The bill is yellowish, and has more extensive area of blue skin around eye.

Size, Habitat & Altitude Range

Body Length: 68 cm

Weight : unknown

Habitat : fir forest with dense
rhododendron
undergrowth

Altitude : 3,000-4,000 m

Behaviour

Not much is known and is reported to be similar to those of Himalayan Monal. Usually occurs singly or in pairs and in small groups. Feeds mainly by digging with its strong bill. The Alarm call is 'a shrill, harsh, plaintive cry' uttered repeatedly; also a wild ringing whistle like Himalayan Monal but distinct in tone.

Reproduction & Life Cycle

Call : *woah..woaah..woahh..*
waaah..waaah..waaah..griik

Breeding Season : unknown

Nest Site/ Type : unknown

Clutch Size : unknown

Incubation Period : unknown

The White-tailed Monal¹ is probably a new species of monal that differs from Sclater's monal only in the tail colouration. One specimen from Taksing locality in upper Subansiri had a completely white tail feathers that had dark brownish-black base, and a small chestnut patch at the centre of a few tail feathers. Another specimen had a small chestnut splash on the outer edges close to the dark base of the tail feathers.

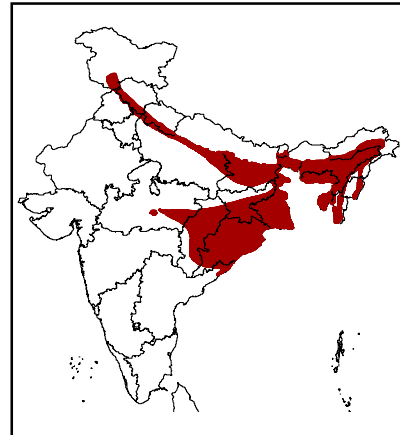
¹ Kumar, R.S., and Singh, P. 2000. Survey for Pheasants with reference to the distribution of genus *Lophophorus* in Arunachal Pradesh, India. Wildlife Institute of India, Dehradun. 35pp.

**RED JUNGLEFOWL *Gallus gallus* Linnaeus 1758**

Vernacular Names: *Jangli murgha*, *Lal murgha*, *Ban murgha* (m), *Jangli murghi*, *Lal murghi*, *Ban murghi* (f), (Hindi, Bengali), *Kattu kozhi* (Tamil, Malayalam), *Yerra aduvu kodi* (Telugu), *Lal raan* (Marathi), *Ban kukur* (Assamese), *Daono* (Assam-Cachar), *Pazok chi* (Sikkim-Lepcha), *Ganga* (Oriya), *Inrui* (Naga-Kacha)



Daniel Cole

**Distribution & Habitat**

Resident and locally common. Distributed in the lower Himalayas (<2,000 m) from Jammu & Kashmir east to Arunachal Pradesh, Shiwaliks, Terai, northeast and eastern India. Inhabits undergrowth in moist mixed forest and scrub jungle interspersed with patches of cultivation and well-watered areas.

Conservation Status

IUCN : others
IWPA : Schedule IV
CITES : not listed

Description

Male is conspicuous with the characteristic red comb and wattle, elongated rufous-orange and golden-yellow hackles across nape and mantle, blackish-brown underparts, crimson band across nape and mantle, blackish-brown underparts, crimson band across back, rufous secondaries, and long greenish-black, sickle-shaped tail. There is an eclipse plumage during monsoon (July-September), after the summer moult, when the hackles are replaced by short, dark brown feathers, the central tail feathers are lacking, and the comb is duller and smaller. During eclipse plumage, head and neck are dark brown, crimson band across back is more clearly apparent, and tail is much shorter. The female has 'shawl' of elongated. Feathers across nape and mantle, and naked reddish face. The remaining upperparts are rufous-brown, finely vermiculated with black, and has rufous-brown underparts streaked with buff. It could be distinguished from the female Grey Junglefowl which has more pronounced 'shawl' and lacks bold white streaking on underparts. It could be distinguished from the female Red Spurfowl, which is stockier, with laterally compressed tail which is often held cocked; fine streaking on breast, and black-streaked golden-buff 'shawl'.

Size, Habitat & Altitude Range

Body Length : 65-75 cm
Weight : 485-1,360 g
Habitat : well-watered areas, undergrowth in moist mixed forest & scrub jungle interspersed with patches of cultivation
Altitude : <2,000 m

Behaviour

Generally occurs in small groups, usually one cock with several hens. It is shy and very secretive, skulking into the undergrowth at the least disturbance. When flushed, it rises cackling, with a clatter of wings. It comes out into the open to feed on forest tracks, firelines, and fields at forest edges during early mornings and late afternoons. It roosts in trees and bamboo clumps. The calling of male at dawn

Reproduction & Life Cycle

Call : cock-a-doodle-doo
Breeding Season : January-October
Nest Site/ Type : under a bush or bamboo clump in forest
Clutch Size : 5 to 6

and dusk, is a loud *cock-a-doodle-doo*, very similar to the crowing of a domestic cockerel, but individual notes less pronounced. Both male and female, utter a variety of cackling and clucking notes, while feeding and when alarm calls.

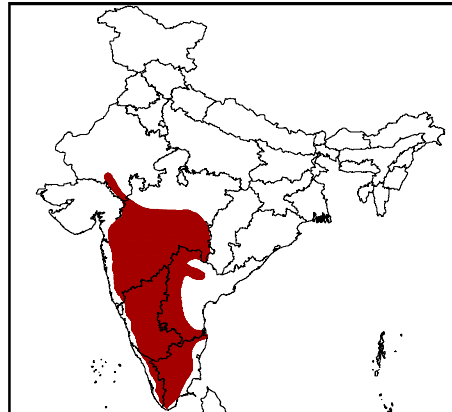


GREY JUNGLEFOWL *Gallus sonneratii* Temminck 1813

Vernacular Names: *Jangli murgha* (m), *Jangli murghi* (f), (Hindi), *Kattu kozhi* (Tamil, Malayalam), *Tella adavi kodi* (Telugu), *Koli Kad koli* (Kanada), *Rakhi ran kombda* (Marathi), *Jangli murgu* (Gujarati), *Komri* (Rajasthani-Mt.Abu)



Daniel Cole



Distribution & Habitat

Resident and locally common. Distributed from south Rajasthan east to central Madhya Pradesh and south through the peninsula and upto 2,400 m in the Nigiris (Western Ghats). Inhabits undergrowth in broadleaved evergreen and deciduous forest, secondary growth, bamboo thickets and patches of cultivation in forest; in southern India also in abandoned plantations; near water sources in summer.

Conservation Status

IUCN : others
IWPA : Schedule II
CITES : II

Description

Male is conspicuous with red comb, face and wattles, 'shawl' of white and pale golden-yellow spotting across nape, neck and mantle, band of golden-yellow spotting on scapulars, grey underparts, back and rump streaked with white, and long sickle-shaped, purplish-black tail. During eclipse plumage, the neck hackles are short and brownish-black, the elongated central tail feathers are lacking and a much reduced comb. The female is similar to female Red Junglefowl, but has less extensive rufous-orange 'shawl' of elongated feathers across hind-neck, and has bold white centres to feathers on underparts.

Size, Habitat & Altitude Range

Body Length : 70-80 cm
Weight : 705-1,136 g
Habitat : undergrowth in broadleaved evergreen & deciduous forest, secondary growth, bamboo thickets & patches of cultivation in forests
Altitude : <2,400 m

Behaviour

As like the Red Junglefowl, but not so gregarious; usually found singly, in pairs or in family parties. It is normally very shy, never venturing far from cover, but tame where not hunted. The male has a distinctive crowing call which is a loud, staccato *kuk-ka-kurruk-ka* repeated at regular intervals, and given four to five times per minute.

Reproduction & Life Cycle

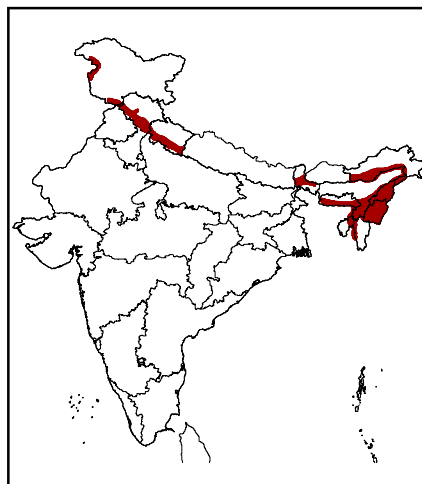
Call : *kuk-ka-kurruk-ka*
Breeding Season : February-May
Nest Site/ Type : under a bush or bamboo clump in forest
Clutch Size : 3 to 5
Incubation Period : 20-21 days

**KALIJ PHEASANT** *Lophura leucomelanos* Latham 1790

Vernacular Names: *Kala murgha*, *Kalesi* (Hindi), *Kaleej*, *Kukera*, *Kalesur* (m), *Kolsa* (Pahri-N.W.Himalaya), *Kansha*, *Kalesa* (Shimla Solan / Pandrabis), *Panti*, *Kulsus* (Kinnaur), *Kar rhyak* (Sikkim-Lepcha), *Modura* (Assam-Cachar), *Darik*, *Dirrik*, *Durug* (Meghalaya-Garo Hills), *Inruitip* (Naga), *Waba* (Manipuri)



Daniel Cole

**Distribution & Habitat**

Resident and locally common. Distributed in the northwestern, western, central and eastern Himalayas (Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh and northern West Bengal) usually <2,700m and in the hills of northeast India (Assam, Meghalaya, Manipur, Meghalaya, Mizoram, Nagaland & Tripura). Inhabits all types of forest with dense undergrowth and thickly overgrown steep gullies, usually not far from water.

Conservation Status

IUCN : others
IWPA : Schedule I
CITES : not listed

Description

The male is glossy blue-black on upperparts, with variable amounts of white on underparts and rump. It has bright red facial skin and wattles, and long, down-curved, laterally compressed tail. The female varies from dull brown to dark red-dish-brown in colour, with grayish-buff fringes giving scaly appearance and has brownish tail. It could be distinguished from female Koklass Pheasant by red facial skin, scaled (rather than streaked) upperparts and underparts, and different shape to tail.

Behaviour

As like the Red Junglefowl. Found in pairs or groups. It spends much time digging and scratching for food. It emerges into the open to forage at forest edges and on tracks during dawn and dusk. It roosts in trees. Calls include a crowing which is described as a loud, whistling chuckle or *chirrup*, and 'a series of guinea-pig-like squeaks and chuckles' or sharply repeated *koorch*, *koorch*, *koorch* or a whistling *psee-psee-psee-psee* when flushed.

Size, Habitat & Altitude Range

Body Length : 65-73 cm
Weight : 564-1,700 g
Habitat : all types of forests with dense undergrowth, thickly overgrown steep gullies usually not far from water
Altitude : 245-3,050 m

Reproduction & Life Cycle

Call : *chirrup*, *koorch*, *koorch*, *koorch*, or *psee*, *psee*, *psee*
Breeding Season : March-October
Nest Site/ Type : a scrape scantily lined with grass/dried vegetation amongst thick undergrowth
Clutch Size : 6 to 9
Incubation Period : 24-25 days



TIBETAN EARED PHEASANT *Crossoptilon harmani* Elwes 1881

Vernacular Names: *Cha-nga*



David Mead



Distribution & Habitat

In India, very rare and only one confirmed record from Tawang, Arunachal Pradesh. In Tibet, summers in patchy subalpine birch and rhododendron scrub and subalpine meadows; winters in spruce and pine forests.

Conservation Status

IUCN : near threatened

IWPA : Schedule I

CITES : not listed

Description

An overall ashy blue-grey pheasant with a bright red naked face, white throat connecting with band across nape and broad laterally compressed tail. It is blacker on neck and white on centre of belly, paler grey rump and uppertail-coverts, and broad blackish, downcurving tail which is glossed with green, blue and purple. Sexes similar.

Behaviour

Keeps in flocks of about five or ten birds in the rhododendron scrub and comes out to feed in the open grassy patches in the mornings and evenings. While feeding, constantly gives a drawn-out cackle. It gets much of its food by digging with its strong bill. When alarmed, it either runs uphill and into the nearest bushes or flies into a nearby tree. During breeding season, calls uttered in unison by both sexes and sounding like a repeated *trip-crrra-ah*, becoming progressively louder and lasting up to 30 seconds. The alarm call is a sharp repeated *wrack*; a conversational cackling that terminates on a high *cucu cuco*.

Size, Habitat & Altitude Range

Body Length : 72 cm

Weight : unknown

Habitat : patchy subalpine birch and rhododendron scrub and subalpine meadows, spruce & pine forests

Altitude : 2,800-4,600 m

Reproduction & Life Cycle

Call : *trip-crrh-ah*,
wrack, cucu cuco

Breeding Season : poorly known

Nest Site/ Type : bark & pulp, line with moss and placed under tree

Clutch Size : unknown

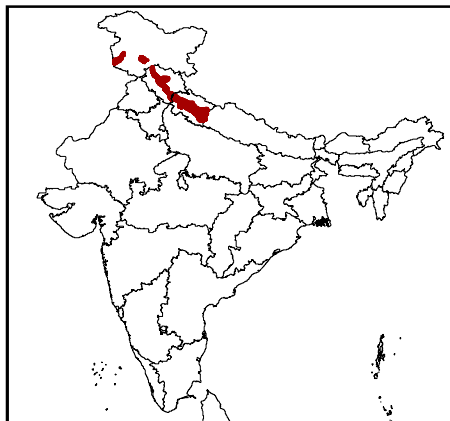
Incubation Period : unknown

**CHEER PHEASANT *Catreus wallichii* Hardwicke 1827**

Vernacular Names: *Chir*, *Chihir* (Garhwali, Kumauni), *Bunchil*, *Herril* (Pahri-N.W.Himalaya), *Chaman(m)*, *Chamani(f)* (Himachali-Chamba), *Tana* (Shimla/Pandrabis), *Reear*, *Rehar* (Kashmiri)



Carl D'Silva

**Distribution & Habitat**

Resident and uncommon. Distributed as fragmented populations in the northwestern and western Himalayas (Jammu & Kashmir, Himachal Pradesh, Uttarakhand) between 1,500-3,050 m. Inhabits precipitous, often craggy hillsides with scrub and stunted trees and dissected by wooded ravines or with some scrub and grass cover; village grazing lands and recently cleared areas with secondary growth. Strongly favours early successional habitats.

Conservation Status

IUCN : vulnerable
IWPA : Schedule I
CITES : I & II

Description

A long-tailed Himalayan Pheasant with a long narrow backward projecting brown crest on head, red facial skin, and body in buffy white and pale rusty, closely barred with black. When on flight, the buff, grey and brown body coloration and long broadly banded tail are the characteristic features for identification. The male has unmarked greyish throat and neck, heavily barred buff-and-black mantle and back, rufous rump barred with black, and greyish breast becoming more buffish on belly and flanks. Tail has broad buffish-white banding and with black-edged chestnut bands across outer feathers, and black-mottled grey-brown bands across central feathers. The female is similar to male, but has more rufescent upperparts, with prominent shaft streaking. It is more heavily barred on breast, and has rufousbrown lower breast and belly scaled with buff, grey-brown rump mottled with black and buff, and narrower buff bands across tail.

Behaviour

Keeps in groups of five or six while feeding on the open hillsides and well hidden under dense undergrowth. It is a very shy bird and when disturbed, prefers to run off rapidly or skulk in thick undergrowth. When flushed, it rises noisily and dives downhill. It often roosts together in trees. Call is a far-carrying, loud *chir-a-pir chir*, *chir chirwa*, *chirwa*. It also gives contact and chorus calls (dusk and pre-dawn), which include high piercing whistles, *chewewoo*, interspersed with short cut calls and short staccato harsh notes.

Size, Habitat & Altitude Range

Body Length : 90-118 cm

Weight : 1,250-1,700 g

Habitat : precipitous, often craggy hillsides with scrub & stunted trees & dissected by wooded ravines, scrub & grass cover, recently cleared areas with secondary growth

Altitude : 1,500-3,050 m

Reproduction & Life Cycle

Call : *chir-a-pir*, *chir-a-pir*, *chir*, *chir chirwa*, *chirwa*, *chewewoo*

Breeding Season : late April-early June

Nest Site/ Type : no nest, eggs are laid in undergrowth on rough grounds

Clutch Size : 9 to 14

Incubation Period : 26 days

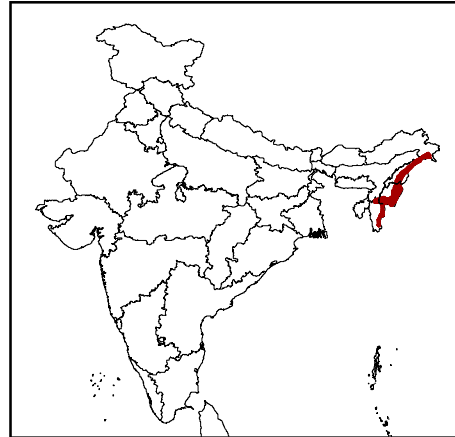


MRS HUME'S PHEASANT *Syrmaticus humiae* Hume 1881

Vernacular Names: *Loningkoi*, *Noiningkoi* (Manipuri), *Nongin* (Manipuri-Chiru tribe)



Carl D'Silva



Distribution & Habitat

Local resident and rare. Recorded from Manipur, Mizoram and Nagaland, at 1,200-3,000 m; only recent records are from Mizoram. It inhabits steep rocky slopes with open oak and pine forest and long grass, bracken and bushes.

Conservation Status

IUCN : vulnerable
IWPA : Schedule I
CITES : I

Description

A long straight-tailed pheasant as like the Cheer Pheasant, but the male is much brighter coloured and lacking the crest. The male has bright red facial skin, glossy blue-black head, neck, upper breast and upper mantle, and mainly chestnut upperparts and underparts. It has broad white band along scapulars, white wing-bars and white tips to tertials. The rump and uppertail-coverts are glossy blue-black, with fine white barring, and the long grey tail is narrowly banded with chestnut and black. The female is grey-brown on upperparts, cryptically mottled and barred with black, and prominently spotted with white on mantle. The underparts are pale rufous-brown, barred with buff. It has suggestion of greyish band along scapulars, and narrow whitish wing-bars formed by tips to greater coverts and secondaries. The female's tail is shorter than male's central tail feathers and are sandy-brown, banded with black and rufous-brown and tipped with white, and outer feathers are chestnut with prominent white tips and black subterminal bands.

Size, Habitat & Altitude Range

Body Length : 90 cm
Weight : 1,080 g
Habitat : steep rocky slopes with open oak & pine forests & long grass bracken & bushes
Altitude : 1,200-3,000 m

Behaviour

Very little known in the wild; probably similar to those of Cheer Pheasant. Calls include a very distinctive crowing *cher-a-per, cher-a-per, cheria, cheria*, also repeated cackling *waaak* notes, and a sharp alarm note, *tuk tuk*.

Reproduction & Life Cycle

Call : *cher-a-per, cher-a-per, chir chir, cheria cheria, waaak, tuk tuk*
Breeding Season : April-May
Nest Site/ Type : no nest, eggs under a bush, rock or grass clump
Clutch Size : 6 to 10
Incubation Period : unknown

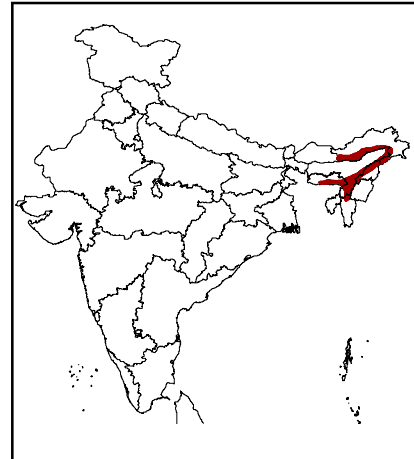


GREY PEACOCK PHEASANT *Polyplectron bicalcaratum* Linnaeus 1758

Vernacular Names: *Munowwar, Deyodahuk, Deoderik* (Assamese), *Dao dip, Dao dai dip, Mejoor* (Assamese-Cachar), *Deodurug* (Meghalaya-Garo) *Burruninrui* (Naga-Kacha)



Kim Franklin



Distribution & Habitat

Resident and fairly common in undisturbed forests. Distributed in the central and eastern Himalayas (Sikkim, Arunachal Pradesh) and northeast India (Assam, Meghalaya, Manipur, Mizoram, Nagaland, Tripura). Inhabits dense undergrowth in tropical moist, broadleaved evergreen and semi-evergreen forest.

Conservation Status

IUCN : others
IWPA : Schedule I
CITES : II

Description

The male is grayish brown with short-tufted crest and long broad tail. It is finely spotted and barred with whitish, and strikingly marked with whitish-rimmed iridescent purple and green ocelli on mantle, wing-coverts, tertials, uppertail-coverts and tail. The female is similar, but is smaller, with shorter tail and shorter crest, and is more uniformly brown with smaller and duller ocelli on mantle, wing-coverts and tail. The older female is similar to male except for shorter tail.

Size, Habitat & Altitude Range

Body Length : 48 cm
Weight : 568-910 g
Habitat : dense undergrowth in tropical moist broadleaved evergreen & semi evergreen forests
Altitude : <1,200 m

Behaviour

Found singly or in pairs, it is a great skulker and very swift on its legs. Most often heard than seen, especially during the breeding season. The call is a deep guttural *hoo*, rapidly repeated about seven times, and soft chuckling notes. Also an *Ok-kok-kok*.

Reproduction & Life Cycle

Call : guttural *hoo, ok-kok-kok-kok*
Breeding Season : March-June
Nest Site/ Type : on ground among thick vegetation
Clutch Size : 2
Incubation Period : 21 days

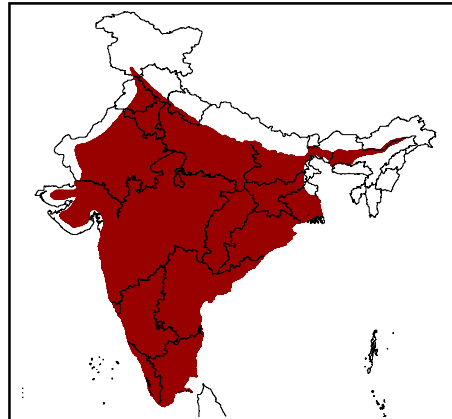


INDIAN PEA FOWL *Pavo cristatus* Linnaeus 1758

Vernacular Names: *Mor*, *Manjur*, *Mayura* (Hindi), *Mayil* (Tamil, Malayalam), *Nemali* (Telugu), *Navilu* (Kannada), *Mor(m)*, *Dhe(f)* (Gujarati), *Mor(m)*, *Landor(f)* (Marathi), *Mayur* (Bengali), *Manja(m)*, *Mania(f)* (Oriya), *Moirā* (Assamese), *Mongyung* (Sikkim-Lepcha), *Dode* (Meghalaya-Garo), *Wahong* (Manipuri)



Kim Franklin



Distribution & Habitat

Resident and locally very common. Distributed throughout much of India except for the Himalayas and northeast India. Inhabits undergrowth in a variety of forests and scrub near streams; also in agricultural lands, villages, and in institutional campuses in urban areas. Introduced in Andaman and Nicobar islands and Sikkim.

Conservation Status

IUCN : others
IWPA : Schedule I
CITES : not listed

Description

A familiar and universally known pheasant. The male has its characteristic fan-like crest, glossy blue crown, neck, upper mantle and breast, metallic green lower mantle and back, and spectacular glossy green train which comprises of numerous elongated uppertail-coverts with blue-centred, green copper ocelli. The female lacks sweeping train, and has fan-like crest, whitish face and throat, chestnut-brown crown and hindneck, metallic green upper breast and mantle, white belly, and brown back, rump and tail. Primaries are dark brown.

Size, Habitat & Altitude Range

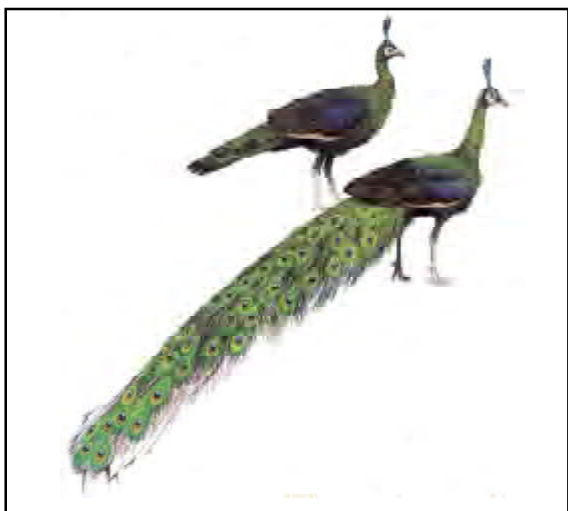
Body Length : 180-230 cm
Weight : 2,750-6,000 g
Habitat : in undergrowth in deciduous forests near streams, where semi-feral, lives in villages and cultivation
Altitude : <1,800 m

Behaviour

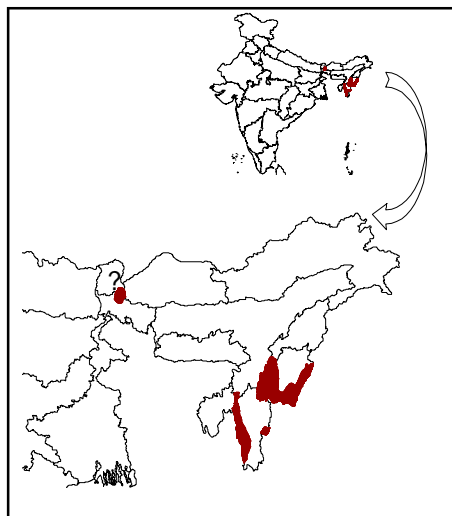
It is gregarious, generally in small groups of usually one cock and three to five hens when breeding, and often in separate parties of adult males and of females with immatures in the non-breeding season. It roosts in tall trees and emerges from dense thickets in early mornings and late afternoons to feed in forest clearings and fields at forest edges. It is protected for religious or sentimental reasons in many parts of India, where it has become very tame, but is quite shy and secretive where hunted. Call is a trumpeting, far-carrying and mournful *kee-ow, kee-ow, kee-ow* and also series of short, gasping screams, *Ka-an..ka-an..ka-an*, repeated six to eight times, and *kok-kok* and *cain-kk* when alarmed.

Reproduction & Life Cycle

Call : *kee-ow, kee-ow, kee-ow, ka-an, ka-an, ka-an, kok-kok, cain-kok*
Breeding Season : January-September
Nest Site/ Type : on ground among dense undergrowth, semi-feral birds on buildings
Clutch Size : 4 to 6
Incubation Period : 28 days

**GREEN PEA FOWL *Pavo muticus* Linnaeus 1766****Vernacular Names:** *Pegu majura* (Bengali), *Wahong* (Manipuri)

Kim Franklin

**Distribution & Habitat**

Resident and very rare. Recorded from eastern (west Bengal) and northeastern India (Assam, Manipur, Mizoram), but now is very rare and believed to be exterminated from the Indian subcontinent. A recent report has confirmed the presence of Green Peafowl in Chintupui and Lunglei districts, Mizoram. It inhabits dense forest near streams or clearings.

Conservation Status

IUCN : vulnerable
IWPA : Schedule IV
CITES : II

Description

At a glance, the male apparently resembles the India Peafowl, but has erect tufted crest, blue and yellow facial skin, green neck and underparts, green coverts, and uniform brown tertials and secondaries. It has long train as on Indian Peafowl, but with stronger bronze, copper and purple hues. The female lacks long train and ocelli, but is similar to male except that lower back, rump, scapulars and tertials are blackish-brown, barred with buff and lightly glossed with green, elongated golden-green uppertail-coverts, which fall short of tail tip, are barred with buff and brown. The tail is barred buff, brown and black.

Size, Habitat & Altitude Range

Body Length : 180-300 cm
Weight : 3,850-5,000 g
Habitat : dense forest near streams
or clearings
Altitude : <1,000 m

Behaviour

Similar to those of Indian Peafowl, but extremely shy and generally does not emerge into forest clearings and edge. The male has a very loud, far-carrying *ki-wao* or *yee-ow*, often repeated. The female give loud *aow-aa*, often repeated with short intervals.

Reproduction & Life Cycle

Call : *ki-wao* or *yee-ow*
aow-aa
Breeding Season : January-May, July-September
Nest Site/ Type : in dense forests
Clutch Size : 3 to 6
Incubation Period : 26-28 days





4.0 An Assessment of the Current Status of the Indian Peafowl (*Pavo cristatus*) in India based on Questionnaire Surveys

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Introduction

The Indian Peafowl (*Pavo cristatus*) has been an integral part of the people of the India and their culture for centuries. From religion and mythology to civilization and socio-culture, the Indian Peafowl occupies an important place in the lives of the people. In addition to this, the Indian Peafowl is well recognized for its ecological and aesthetical values, and hence aptly declared as the 'National Bird' of India in the year 1963.

The Indian Peafowl is widely distributed throughout India except for the Himalayan ranges, north east India and the Islands (Ali and Ripley 1983), but is now reported to be discontinuously distributed in its former distribution range. It was introduced into the Andaman and Nicobar Islands (Ali and Ripley 1983) and also in Kitam Wildlife Sanctuary, South Sikkim (Lachungpa, U., *this issue*). Although the Indian peafowl is widely distributed and locally abundant or fairly common in some areas, the present population status of this species is only speculative. Most of the Protected Areas (PAs) in India do not regularly monitor the populations of the Indian Peafowl within their areas despite this species being the 'National Bird' and even though it forms a prey for large carnivores such as the Tiger and Leopard.

Since the early 1990s, there have been reports of increasing illegal trade in peafowl feathers, large-scale mortalities due to increased use of insecticides/pesticides in agricultural lands, poaching, and retaliatory killings by people due to alleged crop depredation by peafowl. Several peafowl stronghold areas in the country are now concerned about the current declining status.

With this in view, a macro-level questionnaire based information collection and collation on the status of Indian Peafowl was initiated by the Wildlife Institute of India (WII), Dehradun, with the following objectives: (i) to assess the status of the Indian Peafowl in the different PAs and other forested landscapes; (ii) to assess the status of the Indian Peafowl in other land areas such as revenue lands and private lands; and (iii) to assess the range of threats to this species and their mortalities in Protected Areas (PAs), outside PAs, and the agricultural landscapes.

Methods

WII initiated the Questionnaire Survey in 2004 to determine the population status of the Indian Peafowl in the PAs. The questionnaires were sent to all the PA managers (N=448) of the Peafowl range states through their respective Chief Wildlife Wardens. In addition to this, during 2006, WII had initiated another similar Questionnaire Survey through a networking approach to determine the present status of the Indian Peafowl in areas that are not within the PA network or forested land areas (revenue lands, agricultural lands, and private lands) as it was believed that a large percentage of the Indian peafowl populations occur in such areas that are not under the control of the Forest or Wildlife Departments. This questionnaires were sent to members of the civil society (N = 1,720) which includes District Collectors (n=350), Members of Wildlife Network Groups such as Indian Bird Conservation Network (IBCN), Wildlife Rescue Network of the Wildlife Trust of India (WREN), Bombay Natural History Society (BNHS) and other NGOs and NGIs (n=1,470).

These questionnaires sought information on the presence/absence, relative abundance (encounter rates per km or hour), population estimates, threats to peafowl and their habitats, mortalities due to pesticide use in agricultural landscapes, illegal peafowl feather trade, and poaching cases both inside and outside PAs and forested landscape.

Results of the Survey:

Current distribution of the Indian Peafowl in India

As of September 2007, WII has received responses from 234 PAs (52% of 448 PAs) of which 193 (82%) have reported presence of the Indian Peafowl (Table 1). The PA managers also reported presence of peafowl in 19 other areas that includes Reserved Forests and forest land areas. Of the 519 Districts of India that fall within the Indian Peafowl distribution range, the Indian Peafowl has been reported from 345 districts (67%) and the information is not available for the remaining districts (Table 2). Out of the 1,720 questionnaires sent to members of the civil society, only 108 (6%) have responded as of September 2007.



The current distribution of Indian Peafowl constitutes the mainland India including Assam, excepting all other north eastern states and high altitude ranges (>2,000 m) of northern states. There is no change in the distribution of the Indian Peafowl in India with that of its past distribution (Ali and Ripley 1983) but appears to have become discontinuous in some areas from where information is not available. It is likely that some well developed highly populated urban and industrial areas may not hold Indian peafowl populations with the exception of a few pockets such as institutional or university campuses. A distribution map based on presence /absence of Indian Peafowl in the different PAs and Districts of India based on the responses of the questionnaire survey has been prepared (Fig. 1). The Indian Peafowl occurs in a variety of forest types and habitats in India (Fig. 2).

Relative Abundance and Population trends of Indian Peafowl in PAs

Of the questionnaires sent to 448 PAs that are located in the Indian Peafowl distribution range, only 234 PAs (52%) had responded. Of the 234 PAs that responded, only 61 PAs have reported population estimates for the Indian Peafowl in their areas and the total population in these 61 PAs range from 30,965 to 31,939. While some PAs provided encounter rates (# seen/hr effort) for the Indian Peafowl, many PAs did not report for this parameter. From the responses received, it appears that several PAs in Gujarat, Haryana, Himachal Pradesh, Madhya Pradesh and Orissa have the highest Indian Peafowl Encounter Rates of >50 birds/hr effort. While some PAs in Karnataka, Rajasthan, Tamil Nadu and Uttarakhand have reported Encounter Rates of 31-50 birds/hr effort; most of the PAs in India reported Encounter Rates ranging from 5 to 30 birds/hr effort (Fig.3). The peafowl population trend as reported by the PAs (N=167) indicate that the peafowl population is 'increasing' in 73 PAs (43.7%), 'stable' in 36 PAs (21.5%), decreasing in 6 PAs (3.6%), and for the remaining (31.2%) the trend is either 'unknown' or 'not reported'.

Relative abundance and population trends of Indian Peafowl outside PAs

The Indian Peafowl presence was reported from 19 localities other than forested landscape, of which, only 5 reported the population estimates which total to about 3,000 birds. The peafowl population status outside PAs but within the forested landscape areas was also reported from 13 localities. While the population trend was reported as 'increasing' in five localities (38.4%), and 'stable' in two localities (15.4%), it was reported as 'not known' in two localities (15.4%) and 'Not Reported' in the rest.

Responses from civil society members on the presence/absence, relative abundance and population trends of the Indian Peafowl in areas outside PA or Forest land areas indicate that there are at least 121 areas that have Indian Peafowl. Thirteen Respondents reported decline in Indian peafowl population from 18 localities across India. The total population reported in these areas excluding figures for Madhya Pradesh, Orissa, Tamil Nadu and Uttar Pradesh add up to a range of 14,176 to 16,201. The responses from Civil Society members indicate that the Indian Peafowl population outside PAs and forest land areas to be about 11,69,000 in Madhya Pradesh, 1,82,000 in Orissa, 77,000 in Tamil Nadu and about 91,000 in Uttar Pradesh. All of the above add up to an estimate of about 15,35,000 Indian Peafowl outside PAs and forest land areas. However, reliability of such estimates is questionable as the methods followed and the capacity of individuals who made such estimates are not known. At the best, these could be considered as guesstimates.

Overall status, distribution and abundance in India

From the above, we could summarize that the Indian Peafowl presence is confirmed in 345 districts of India and it is likely to be present in 174 other districts that fall within the Indian Peafowl distribution range. The Indian Peafowl populations are reported to be present with 193 PAs, 19 other forest land areas, and 141 revenue land areas. Of the total 353 localities that have reported Indian Peafowl presence, the population estimates are available for 195 localities only. The total population estimated within the 195 localities is over 15,00,000 birds. However, as mentioned earlier, such estimates have to be treated as guesstimates only.

From the above, it is clearly evident that there is an urgent need to obtain basic information on Indian Peafowl presence/absence, encounter rates and population estimates from the PAs, outside PAs, including revenue and private lands for the better management of the National Bird. It appears that substantial portions of Indian Peafowl distribution range and populations are outside the PA network or Forest land areas.

Indian Peafowl - People Interface

The Information on use of agricultural/horticultural lands adjacent to and/or near PAs by the Indian Peafowl was reported by 146 PAs. While 64 PAs (44%) reported use of agriculture/horticulture lands by peafowl as 'occasional', 15 PAs (10%) reported the use of such lands as 'very often', 58 PAs (39.8%) reported that there was no such use and the remaining did not provide this information. Cases of crop depredation by Indian Peafowl from agriculture lands near the PAs were reported as 'occasional' in 55 PAs (37.7%), 'very often' in 7 PAs (4.8%), 'nil' in 42



PAs (28.8%), 'not known' in 1 PA, and the rest (28.1%) did not report.

In the 13 forest land areas outside PA network where the Indian Peafowl was reported to be present, reports of Indian Peafowl using agricultural/horticultural lands was received from 10 localities. The cases of crop depredation by Indian Peafowl from agriculture lands near the forested areas were reported as 'occasional' in 8 areas.

Indian Peafowl: Mortalities, Poaching and Trade

The information on Indian Peafowl as prey for carnivores, mortalities, poaching and trade was compiled from responses received from 146 PA managers. Seventeen PAs reported that Indian Peafowl was preyed by wild carnivores such as tiger, leopard, leopard cat, jungle cat, caracal, wild dog, wolf and jackal. Over 80% of the PAs did not report mortalities of peafowl in and around their PAs and only 5% reported such cases in the agricultural landscapes near PAs. The remaining PAs did not respond.

Encounter of shed peafowl feathers were reported as "occasional" by 98 PAs (58.7%), and 'very often' by 22 PAs (13.2 %). Thirty nine PAs (23.3%) reported that shed peafowl feathers were 'not encountered' in their areas, and the remaining did not provide this information. The collection of shed peafowl feathers by people was reported as 'occasional' by 43 PAs (25.7%), 'very often' by 5 PAs (3%), and 'no such collection' by the rest. Only 10% of the PAs reported instances of poaching / illegal trade in their areas. Most of the PAs (79%) reported 'no poaching and / or illegal trade' in their areas, and the remaining did not provide information.

In the 13 forest land areas outside PA network where the Indian Peafowl was reported to be present, none of them reported mortalities of Indian Peafowl from agricultural landscapes. Encounter of shed peafowl feathers were reported as "occasional" in seven localities, and as 'not encountered' in five. The collection of shed peafowl feathers by people was reported as 'occasional' in eight localities, as 'no such collection' in four. No poaching and/or illegal trade of Indian Peafowl or its feathers from these areas was reported. Response for the above parameters for one locality was not received.

Of the 108 responses that were received from civil society members regarding the mortalities, poaching and trade of Indian Peafowl outside PAs and forest land areas, 19 Respondents reported Indian Peafowl in the diet of species such as leopard, bear, fox, jackal, mongoose and feral or domestic dog. Twenty eight Respondents reported about 1,000 cases of poaching or trade and mortalities of Indian Peafowl from 15 localities across India. Mortalities due to increased use of pesticides and insecticides in

agricultural landscapes, and decline in population due to habitat loss as a consequence of changing land use patterns, some levels of poaching for meat by tribal or local people, retaliatory killings to reduce crop depredation, were the reasons.

From the above, it is evident that the Indian Peafowl forms one of the important prey for large and small carnivores both within and outside PA network or forest land areas. There are reports of Indian peafowl mortalities in agricultural landscapes due to effects of insecticides / pesticides, poaching for meat, and retaliatory killings to reduce crop depredation. The Indian Peafowl populations outside PAs, including revenue and private lands appears to be facing problems due to changing land use practices, and some level of poaching or retaliatory killings.

The Proposed Plan of Action

We realized the limitations of this Questionnaire Survey as the responses were much less than expected, and that some of the information provided on population estimates may not be very reliable. Information on availability and collection of shed feathers was also not provided by most of the respondents. There were also problems in interpreting dissimilarities between media reports versus responses on Indian peafowl mortalities in agricultural landscapes.

As a follow up of the questionnaire survey, WII proposes to coordinate a national level Indian Peafowl Monitoring Programme networking with five regional institutions in the country, NGOs, NGLs and the State Forest/Wildlife Departments. WII also proposes to use and analyse the field based data generated by Phase-I of the "All India Tiger, Co-predators, Prey and Habitat Monitoring Programme", in which information on the presence/absence and relative abundance of the Indian Peafowl at the Beat Level for all the 17 Tiger Range States has been collected. This could serve as the baseline for regular monitoring of Indian Peafowl in the Tiger landscapes of the country.

References

Ali, S., and Ripley, S.D. (1983) *Handbook of the Birds of India and Pakistan*. Oxford University Press, Delhi.



Table 1 Indian Peafowl Presence / Absence in Protected Areas of India as of 15 September 2007

Name of States/UTs	TotalNo. of PAs	No. of PAs that reported Indian Peafowl as 'Present'	No. of PAs that returned the Questionnaire
Andhra Pradesh	26	11	15
Assam	23	2	22
Bihar	11	3	3
Chandigarh	2	0	0
Chattisgarh	13	2	2
Delhi	1	0	0
Daman and Diu	1	0	0
Dadra and Nagar Haveli	1	0	0
Goa	7	4	4
Gujarat	25	2	2
Haryana	12	12*	10
Himachal Pradesh	34	8	25
Jammu and Kashmir	19	0	0
Jharkhand	11	11	11
Karnataka	26	24*	15
Kerala	19	6	17
Madhya Pradesh	34	13	13
Maharashtra	42	40*	28
Orissa	20	13	14
Punjab	11	9	11
Rajasthan	28	10	10
Tamil Nadu	24	15	24
Uttarakhand	14	1	4
Uttar Pradesh	24	6*	4
West Bengal	20	0	0
Total	448	193	234

* Indian Peafowl presence reported by CWLW of the state, but questionnaires from PA managers in a few cases is awaited

**Table 2** Presence / Absence of the Indian Peafowl in the Districts of the Range States and Union Territories of India, as of 15 September 2007

Name of States/UTs	No. of Districts	No. of Districts that has Peafowl	No. of Districts where Peafowl Presence is 'unknown' but likely to be 'present'
Andhra Pradesh	23	23	0
Assam*	10	10	0
Bihar	37	5	32
Chandigarh	1	0	1
Chhattisgarh	16	16	0
Dadra and Nagar Haveli	1	1	0
Daman and Diu	1	1	0
Delhi	9	2	7
Goa	2	2	0
Gujarat	25	25	0
Haryana	20	9	11
Himachal Pradesh*	9	9	0
Jammu and Kashmir*	4	4	0
Jharkhand	23	14	9
Karnataka	28	25	3
Kerala	14	7	7
Madhya Pradesh	48	48	0
Maharashtra	35	27	8
Orissa	31	31	0
Punjab	17	6	11
Pondicherry	4	1	3
Rajasthan	32	32	0
Tamil Nadu	30	23	7
Uttar Pradesh	70	13	57
Uttarakhand*	11	6	5
West Bengal	18	5	13
Total	519	345	174

* Only Districts in the Indian Peafowl Distribution Range

** Absence of Indian Peafowl in the districts based on published information and secondary sources

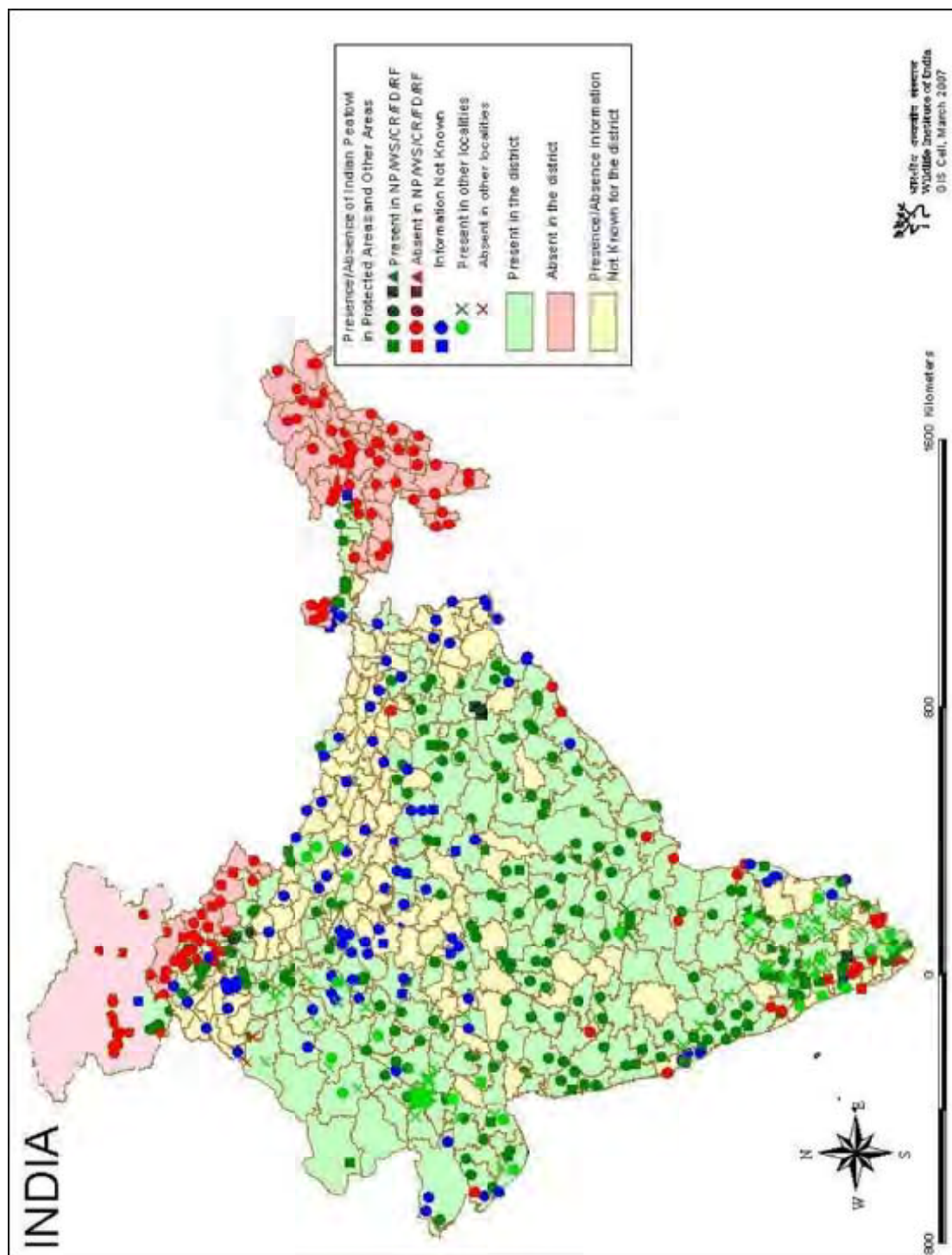


Fig 1: Presence/Absence of the Indian Peafowl in the Protected Areas and Districts of India

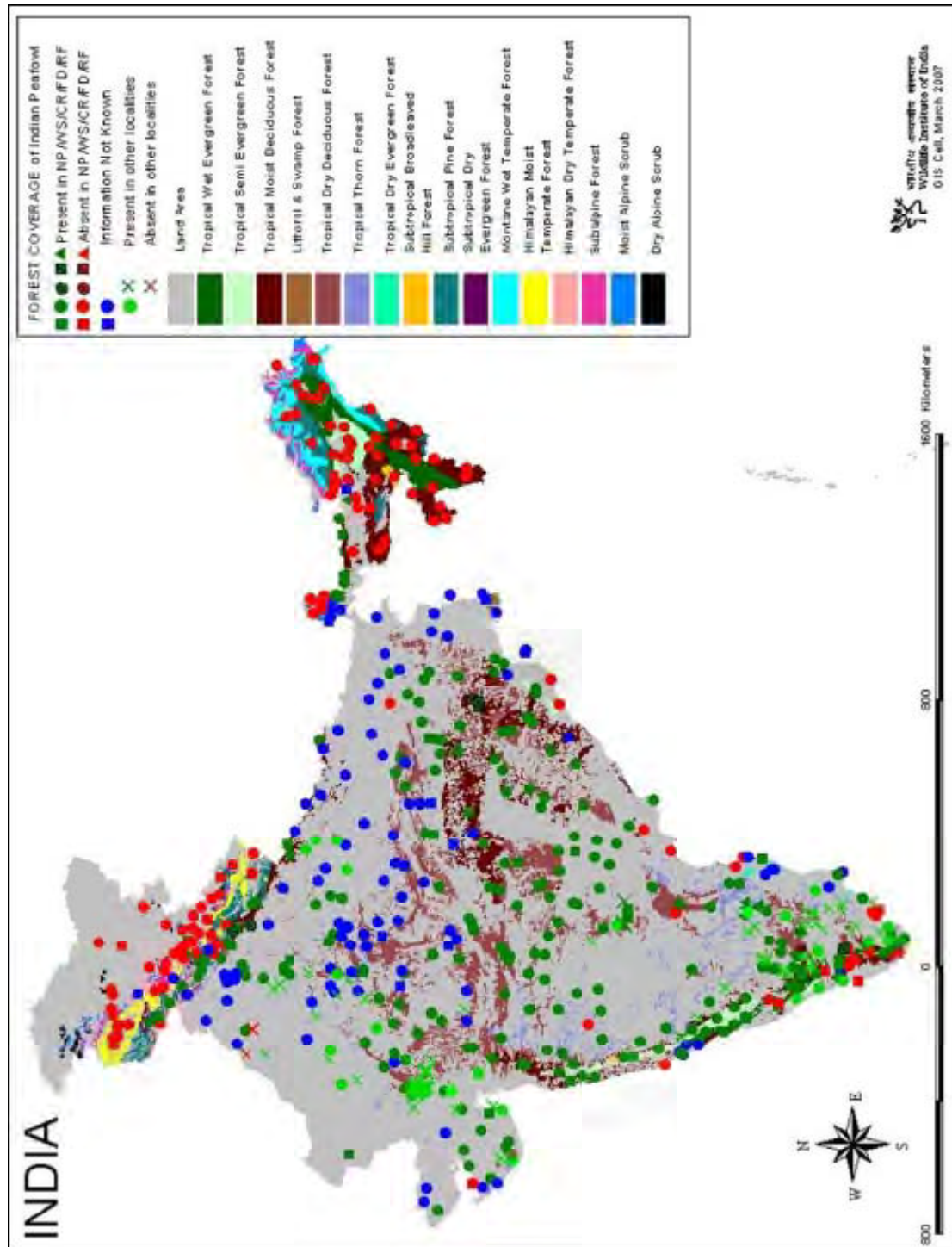


Fig 2 Distribution of Indian Peafowl in different Forest types of India

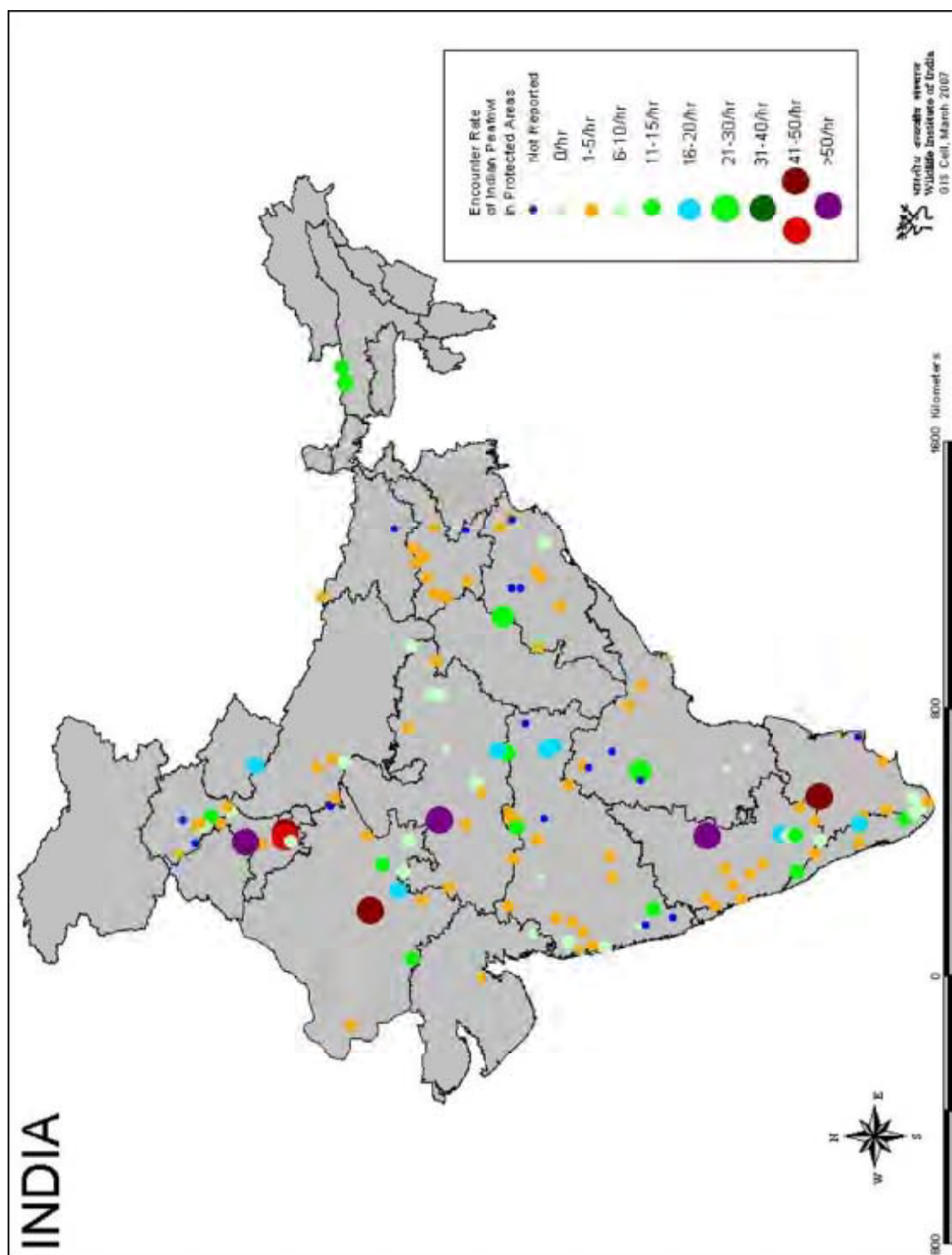


Fig 3: Map showing Encounter Rates of Indian Peafowl in the Protected Areas in India



5.0 Conservation of Red Junglefowl (*Gallus gallus*) in India – Towards mapping Abundance and Genetic Diversity

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Introduction

The Red Junglefowl (*Gallus gallus*) [RJF] is one of the most important species to mankind due to the economic and cultural significance to human civilization. According to Liu *et al.* (2006) there are distinct distribution patterns and expansion signatures suggesting that different clades of chicken might have originated from different regions, which also support the theory of multiple origins in South and Southeast Asia. In other words, the present day multi-billion dollar poultry industry is based on the wild RJF and may have to depend on it in the future as well. India is the fifth largest egg producer with over 40 billion eggs and over 650 million broilers (www.fao.org). Andersson *et al.* (1994) have stated that 'populations of domestic animals and their wild ancestors provide a valuable source of genetic diversity that may be exploited to develop animal models for quantitative traits of biological and medical interest. Conservation of genetically pure wild forms or their representatives have great potential to make significant contribution to the study of some economically important genetic traits of the domestic form (Brisbin 2002).

The RJF has widespread distribution and in its five sub-species are spread from the Indian sub-continent eastwards across Myanmar, South China, Indonesia to Java (Johnsgard 1986). In India, two sub-species of RJF occur, the type specimen, *Gallus gallus murghii* and *Gallus gallus spadiceus* (Ali and Ripley 1983). While the former is distributed in the north and central part of India, extending eastwards to Orissa and West Bengal, the later is confined to the North-eastern parts of India. Recently, fears have been expressed that the wild RJF populations may be genetically contaminated leading to an inference that there may not be any pure RJF populations in the wild (Peterson and Brisbin 1998). They may have hybridised with feral and/or domestic stock, especially near the villages causing introgression of domestic genes into the wild populations.

The skins that were examined by Peterson and Brisbin (2001) showed lack of phenotypic traits, which characterise true wild RJF as described by Morejohn 1968.

Further, the pattern of genetic contamination as suggested by Peterson and Brisbin (1998) in wild RJF is also contentious. Irrespective of the apparent sampling inadequacy, the threat of hybridisation to the RJF in India is real and needs to be addressed urgently. Keeping this in view, a collaborative study was initiated in mid 2006 to provide more information on the status and distribution of RJF in India and ways in which to safeguard the genetically pure wild populations. This paper presents the preliminary findings of the ongoing study for the period upto September 2007.

Materials and Methods

Assessing the status and distribution of RJF in India

In order to assess the distribution and status of RJF in India the historical distribution range was divided into five different zones viz., North (Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Haryana, Punjab and Uttar Pradesh), Central (Madhya Pradesh and Chhattisgarh), Eastern (Bihar, Jharkhand, West Bengal), Southeast (Orissa and Andhra Pradesh) and Northeastern (Sikkim, Assam, Arunachal Pradesh, Nagaland, Mizoram, Manipur, Tripura and Meghalaya). The 'presence / absence' distribution was assessed based on secondary information from literature, questionnaire surveys, reliable personal communication and field surveys. *Ad libitum* surveys using the encounter rate method were carried out in different habitats and areas to obtain abundance estimates of population (Bibby *et al.* 1992). A minimum of two trails was selected, which was sampled at least thrice. The encounter rates were pooled together for the different forest types.



Identification of pure RJF populations by molecular genetic studies

A composite set of traits were compiled with the help of Morejohn (1968), Johnsgard (1986) Peterson and Brisbin (1998) and Corder (*pers comm*) for identifying the pure wild RJF from that of introgressed hybrids. The traits used were yellowish colour hackle, slender smooth thin blackish legs, white patch at the upper tail coverts, elongated sickle shape central tail feathers, horizontal tail carriage in males while the RJF hen in comparison to a chicken, is slender; smaller in size and has no width across its shoulders, has vestigial or no crest and the tarsus is slender smooth, thin and blackish. In males during the post breeding season it undergoes moulting (eclipse plumage). There were 15 cases where the birds were trapped and measured, measurements of tarsus, bill and comb were noted with the help of a digital vernier calliper. There were some other traits such as semi-transparent thin skin and no protest while handling that was recorded when the bird was in hand.

Sampling

A total of 70 samples of RJF and 43 samples of different breeds of domestic chicken were collected from various parts of India. Out of 70 RJF samples, 32 samples were from wild and 38 samples from captivity. Blood was collected from wing vein of trapped individuals using DNAzol BD and on FTA cards (Mackey *et al* 1997). Freshly pulled primary feathers were directly preserved in absolute alcohol while moulted feathers and hatched egg shell were collected and stored in a zip lock bag for dry preservation.

DNA Extraction from whole blood, tissue, feather and egg shell membrane

Genomic DNA was extracted from blood following DNAzol BD based protocol Mackey *et al* (1996) (U.S. Patent No.5, 945,515). For tissue, feathers and egg shell membrane DNA was extracted using Qiagen DNeasy tissue kit. DNA was quantified with UV spectrophotometer and concentration was adjusted approx. 50-80 ng/μl with TE buffer.

Microsatellite markers

Highly polymorphic microsatellite markers were identified using chicken genome database (www.thearkdb.org) for genotyping of RJF and chicken breeds.

Optimisation of cycling condition and amplification of microsatellite loci

For initial standardisation and optimisation of cycling conditions, four fluorescent labelled primers were used.

Reported conditions for the amplification of microsatellite loci were tested and then accordingly modified to get optimised results. PCR amplification was performed in a 10 μl reaction volume. Each reaction consists 1X PCR Buffer (50 mM KCl, 10 mM Tris-HCl), 1.5 mM MgCl₂, 200 μM of each d-NTPs, 25X BSA, 10 p-mole of each primer (forward and reverse), 0.5 unit of Taq DNA polymerase, 50 to 80 ng of genomic DNA. Protocol for PCR reaction was comprised of an initial denaturation at 94°C for 2 min, followed by 35 cycles of denaturation at 94°C for 45 s, primer annealing for 45 s at 55°C, primer extension for 1 min at 72°C and a final extension of 10 min at 72°C. About 5 μl of PCR product was resolved on 3.0 % Agarose, and 100 bp ladder was used as molecular size markers.

Results

Distribution of RJF *Gallus gallus* in India

The distribution of RJF covers 300 Districts in 21 range states of the India (Fig 1). The RJF is now reported to occur in 136 districts in the 21 range states. Information on the presence / absence of RJF from over 50% of the districts in its distribution range is unknown. Of the 255 PAs that occur within the RJF distribution range in India, 149 PAs (26 NPs and 123 WSSs) have RJF. Information on the presence / absence of RJF from ca. 33% of PAs is unknown. As of March 2007, there were 209 individuals (74 males: 80 females: 55 chicks) of RJF in captivity in the various zoos and pheasantries in the states of Andhra Pradesh, Delhi, Haryana, Himachal Pradesh and Uttar Pradesh.

As there were no population estimates of RJF in the PAs, an attempt was made to obtain abundance estimates for RJF in PAs. Line transect or Trail sampling was used to obtain encounter rates for RJF in the different forest or habitat types found in the RJF distribution range of India. A total of 38 trails covering 358 km were traversed (546 man hours effort) in the seven broad vegetation / habitat types. The encounters rate was pooled together for similar habitats (Table 1). The encounter rate was high during the summer months in the Shivalik region, however, the higher 'Coefficient of Variation' (CV) value reveals that the sampling size was insufficient.

Morphological traits

In total 246 RJF (126 males and 120 females) were sighted during the field surveys and 17 males and 16 females in captivity from which trait characteristics were recorded. All males had presence of the yellowish colour hackle and the slaty black thin tarsus; the ear lobes were white in Orissa while rest of the places had pinkish ear lobes. The tail carriage was difficult to characterise, but the presence of the sickle feather was prominent in all cases. In 50% females, comb was absent, while 20% had



rudimentary comb while in 30% of the cases it was not possible to detect the comb. This was mainly due to cryptic colouration and its behaviour. Eclipse plumage was also observed in RJFs ($n=5$). However captured populations that were examined at the Morni Hill pheasantry during the period (July – September) had shown eclipse plumage.

Isolation of genomic DNA from different tissues

The genomic DNA was extracted from blood, tissue, feather follicles and egg shell membrane. A good quality and quantity of genomic DNA was obtained from whole blood following DNAzol BD protocol (Fig 2). DNA was also extractable from tissue, feather follicle and egg shell membrane, but the quantity as well as quality of genomic DNA extracted from feather follicle and egg membrane was much lower in comparison to the DNA extracted from tissue (Fig 3).

Optimisation of PCR assay for microsatellite genotyping

PCR cycling condition was optimised for four primers viz. MCW 034, MCW 295, MCW 111 and LEI 192. Initially, annealing temperature was optimised for these four microsatellite markers. Annealing temperature between 55°C to 65°C was tested in a gradient PCR amplification. For MCW 034, annealing temperature of 64.9°C was found optimum, while for MCW 295, annealing temperature of 55°C showed better amplification. Similarly, optimum annealing temperature for MCW 111 and LEI 192 was 64.9°C (Fig 4). The average allele sizes for MCW 034, MCW 295, MCW 111 and LEI 192 were ~ 230 bp, 96 bp, 104 bp and 271 bp and were as per similar to those reported by Sharma 2006. After optimising the annealing temperature, the microsatellite genotyping was done on some RJF samples and these amplified products were resolved on 3 % agarose gel (Fig 5).

Discussion

The present state wise distribution is nearly the same in comparison to the historical distribution of Hume and Marshall 1879, Ali and Ripley 1983 and Madge and McGowan 2002. The distribution range is restricted in certain states due to geographical barriers, environmental elevation gradients and human disturbances. Within central India, the RJF is not reported beyond the west bank of river Pench (R. Jayapal *pers. comm*). Ali and Ripley (1983) demarcate the southern most distribution of RJF to be near Rajahmundry but there were records of RJF in Eturnagaram WS (Nagula, 1997) but the present survey did not record presence of RJF in this sanctuary till summer 2007. For a better understanding of the spatial distribution of RJF, habitat suitability modelling will be developed involving satellite imagery, and ecogeographical

variables. From this predictive distribution, the analysed genetic data will be overlaid so as to give different regions with respect to pure and hybrids.

Due to the varied habitat in the distribution range there were constraints in transects repeatability in different seasons hence detection probabilities were not included in the abundance estimates. However we propose to correct for detection probabilities in the different habitats and seasons for the different zones in India by repeating surveys within these same areas that will give an abundance estimate.

In the present study, different samples were used for DNA extraction. The blood and tissue proved to be very good samples for DNA extraction for RJF. Avian blood having nucleated red blood corpuscles (RBCs) is always the sample of choice for DNA extraction. Earlier studies also showed that genomic DNA of good quality as well as quantity can be extracted from frozen and stored chicken blood (Sharma and Apparao, 2000). Extraction of genomic DNA from feather follicle and egg shell membrane is the non-invasive method. The quantity of genomic DNA extracted was quite low with these samples but was enough for PCR amplification.

PCR amplification is influenced by number of factors such as quality and quantity of genomic DNA, concentration of magnesium ions and dNTPs and annealing temperature (Williams *et al.*, 1993) hence, the initial standardisation of PCR amplification conditions are often necessary to get optimum amplification. The annealing temperature 55°C was found optimum for MCW 295 while 64.9°C was the optimum annealing temperature for other three microsatellite markers. These amplified products were resolved on 3 % agarose gel and the average allele size observed for these microsatellite markers were in accordance with that reported by Sharma (2006). Since the microsatellite alleles differ in few base pairs with each other at a given locus, the ordinary agarose gel is not sufficient to differentiate the alleles. Hence for better allele differentiation, the amplified product will to be resolved on metaphor agarose or 4-5 % denaturing polyacrylamide gels or on automated DNA sequencer. Sharma (2006) reported polymorphism not only within RJF population, but also between RJF and chicken breeds on 3.5 % metaphor agarose.

Though these preliminary studies showed the presence of polymorphism within RJF population at these four microsatellite loci but further these microsatellite markers as well as other 17 markers will be used to develop the microsatellite profile of RJF population using automated DNA sequencer. These microsatellite allelic profiles will be utilised for estimating the genetic diversity present within the RJF population. Such estimates will be the suggestive of existing genetic variability between the RJF populations from different



regions of the country. Further genetic distance analysis will be undertaken using the microsatellite allelic profile of RJF with that of chicken and used in testing the purity of RJF. Since the introgression of domesticated chicken genes in wild RJF might affect the phenotypic expression of physical traits such as eclipse plumage, hen comb, leg color, horizontal body posture and tail carriage, simpler and a shorter call, therefore, on identifying of pure RJF, we will try to correlate the genetic purity and the physical traits.

A few sites within the distribution range such as Sariyanj (Himachal Pradesh) will be taken up for intensive studies. These sites will try to address issues with respect to the ecology and behaviour (interactions) of wild RJF with the domestic fowl.

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- <http://www.thearkdb.org/arkdb/do/getChromosomeDetails?accession=ARKSPC00000004> (Date and Time?)

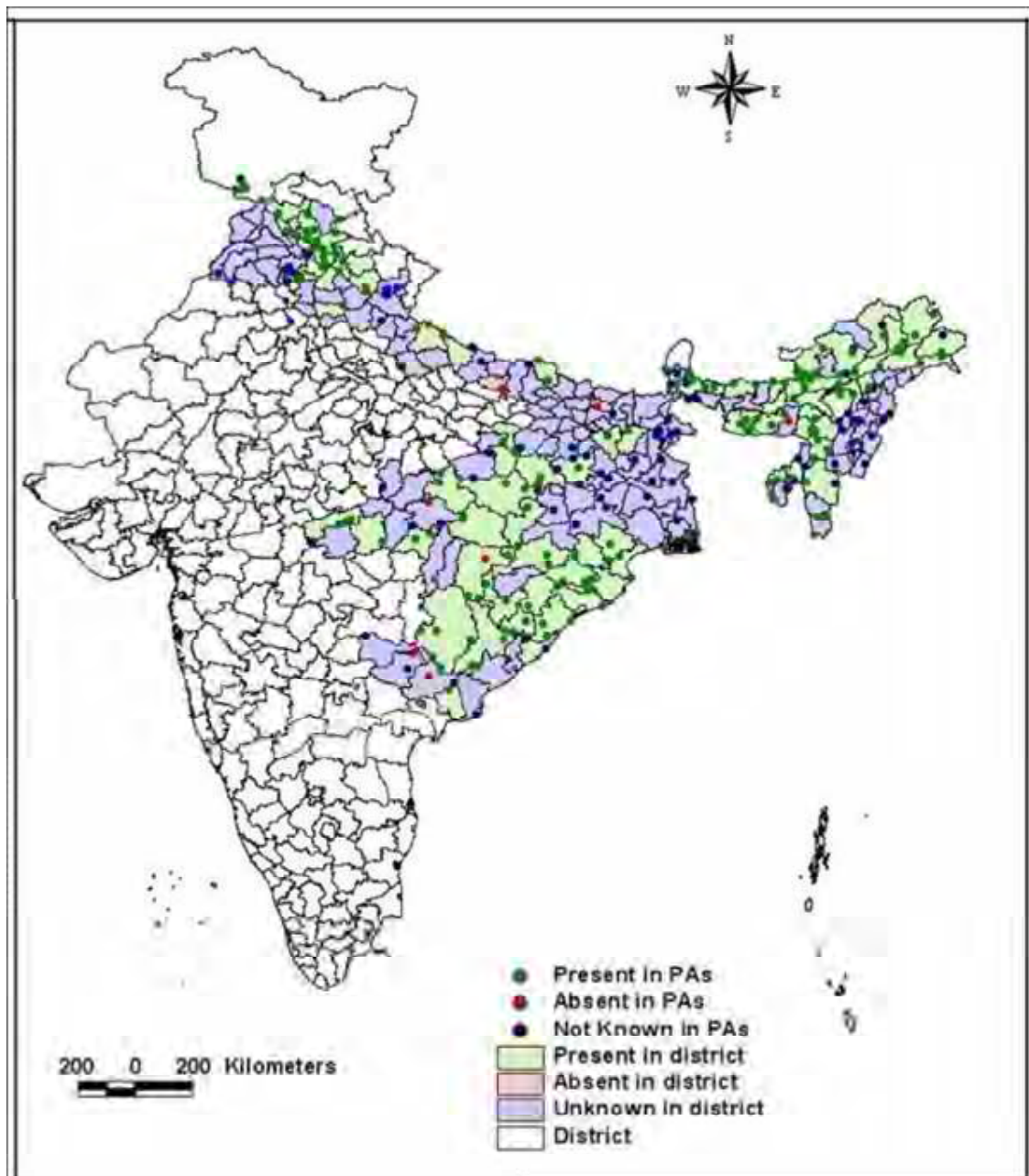


Figure 1 : Distribution of Red Junglefowl *Gallus gallus* in India

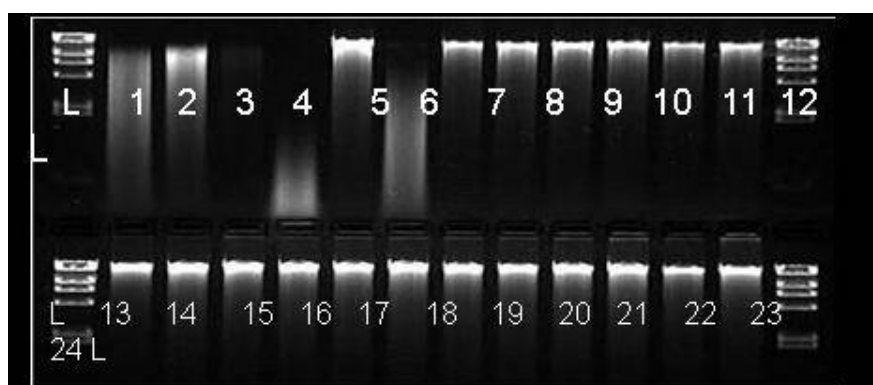


Figure 2. Gel Electrophoresis (0.8% agarose) of extracted DNA, L- 1Kb ladder, Lane- 1 to 12 RJF Samples, Lane- 13 to 24 Domestic Chickens

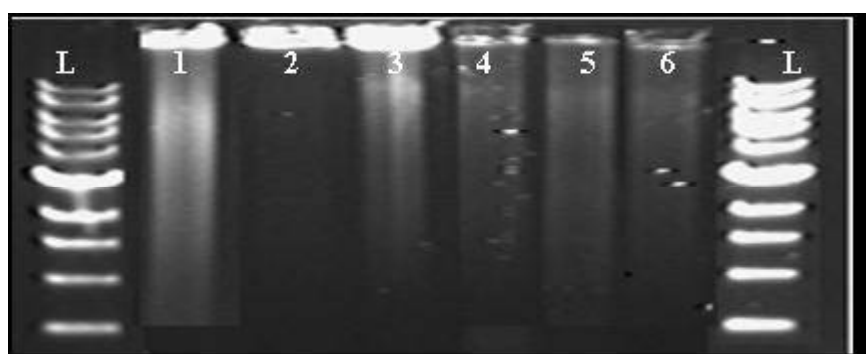


Figure 3. Gel Electrophoresis (0.8% agarose) of extracted DNA, L- 1Kb ladder, Lane- 1, 2, 3 DNA from tissue sample, Lane- 4, 5 DNA from feathers and Lane- 6 DNA from Egg Shell membrane

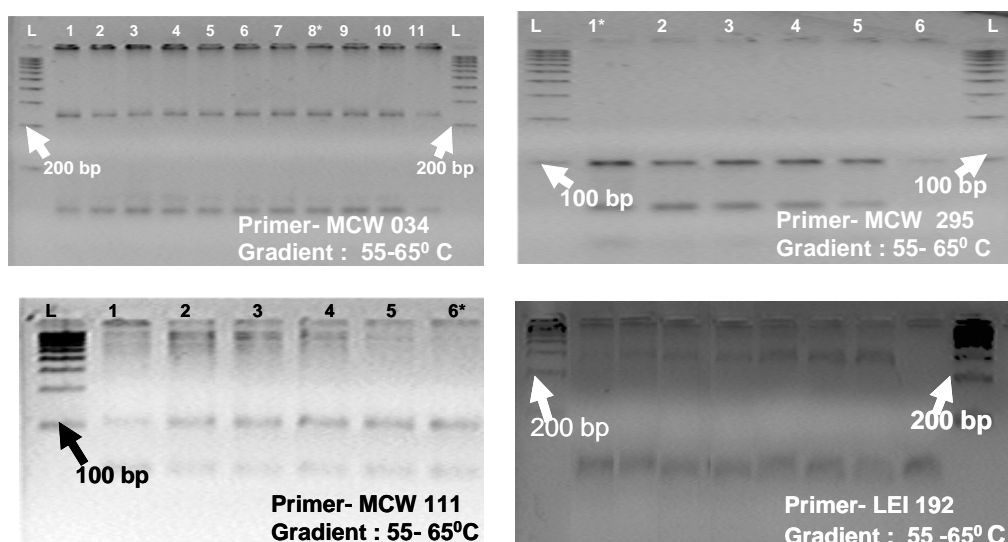


Figure 4. Standardisation of PCR condition for amplification of microsatellite loci
(A) MCW 034, Allele size ~ 230 bp, T_A - 64.9° C, (B) MCW 295, Allele size ~ 96 bp, T_A - 55° C,
(C) MCW 111, Allele size ~ 104bp, T_A - 64.9° C, (D) MCW 192, Allele size ~ 271 bp, T_A - 64.9° C

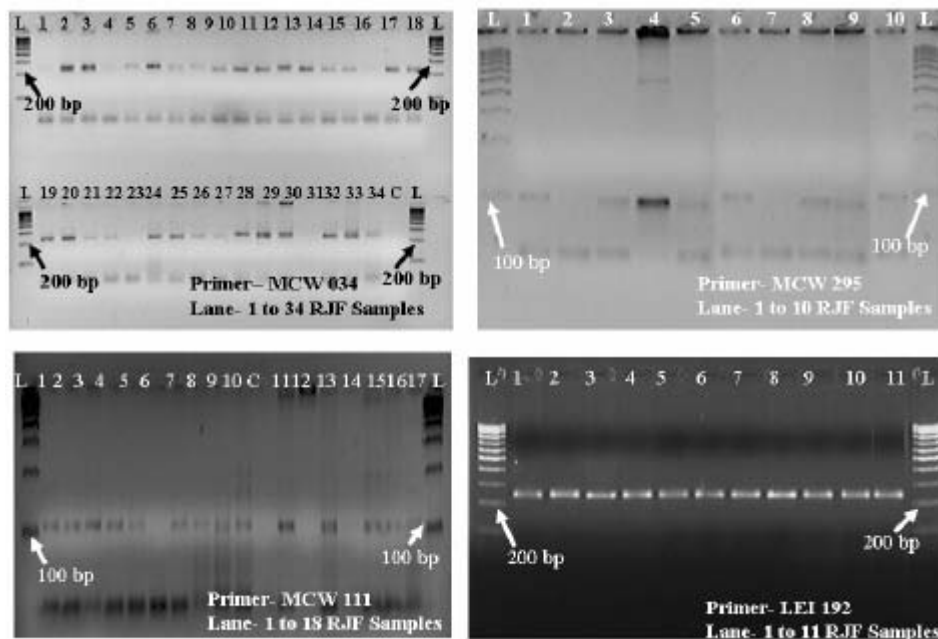


Figure 5. Amplification of microsatellite loci using primer- MCW 034, MCW295, MCW111, LEI 192

Table 1. Encounter rate of RJF in various habitat types of certain Protected Areas.

Forest / Habitat Types	Months	Trails (n)	Total Effort (km)	Mean (no/Km)	Std Error	SampleVariance
Mangroves (Bhittarkanika)	Nov	2 (4)	9.8	1.357	0.295	0.347
Moist mixed forest (parts of Orissa and Udanti WS)	Nov-Dec	6 (10)	46	0.167	0.087	0.076
Dry deciduous (Parts of Andhra Pradesh)	Dec-Jan	11 (16)	103	0.000	0.000	0.000
Moist mixed forest z (Meghalaya and Assam)	Feb-Mar	7 (18)	72	0.466	0.264	0.400
Grassland and Woodland (Assam floodplains)	Mar-Apr	5 (18)	40	1.430	0.202	0.734
Shivaliks (Uttarakhand)	May	4 (12)	19.2	5.056	1.257	18.971
Himalayan Foothills (Himachal Pradesh)	Jun-July	3 (8)	18	0.688	0.298	0.710

(n) = Total number of trails





6.0 Tragopans, the horned pheasants; their Taxonomy, Distribution and Status

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Introduction

Tragopans are commonly referred to the group of five pheasant species represented in the genus *Tragopan* Cuvier 1829 (Phasianidae). The five species are (1) Western tragopan *Tragopan melanocephalus* Gray 1829, (2) Satyr tragopan *Tragopan satyra* Linnaeus 1758, (3) Blyth's tragopan *Tragopan blythii* Jerdon 1870, (4) Temminck's tragopan *Tragopan temminckii* Gray 1831, and (5) Cabot's tragopan *Tragopan caboti* Gould 1857. Subspecies are recognized for Blyth's (*T. b. blythii* Jerdon 1870 and *T. b. molesworthi* Baker 1914) and Cabot's (*T. c. caboti* Gould 1857 and *T. c. guangxiensis* Cheng and Wu 1979). The name 'Tragopan' was apparently derived from the Greek words *Trago* means 'goat' and *Pan*, the Greek god of shepherds and mountain wilds. The males' characteristic 'bleating call' during the breeding season often resembles the call of a stranded goat, while their secretiveness, attractive plumage and the gifted frontal display render them the superior status within the Himalayan pheasants. The term 'horned pheasants' is essentially due to the erectile and brightly colored fleshy horns prominently flaunted by the males during courtship.

The pheasants that exist today evolved from generalized partridge-like ancestors (Johnsgard 1986), and the Tragopans lineage (that also include Blood pheasant *Ithaginis*, Monal *Lophophorus*, and Koklass *Pucrasia*) is the most basal clade (Kimball 1999, Figure 1), meaning that this group diverged early in the evolution of the pheasants. The grouping of Tragopans in the phylogenetic tree was also supported by cladistic analyses of morphology (Dyke et al. 2003) and behavioural and ecological characters (Fuller 2000). However, there were exceptions; the Monal was found to be morphologically closer to the grouse, while on the basis of behaviour and ecological characters, the Blood pheasant diverging from the Spurfowls (which share characters of both partridges and pheasants) formed the basal clade for all the pheasants. The extant five species of Tragopans are manifestation of various geological events and speciation processes. There are explanations pointing to both allopatric (speciation by geographical barrier) and parapatric (by sexual selection or niche separation) mode of speciations. Newton (2003) lists all the Tragopans with

the parapatric species with contiguous or narrowly overlapping ranges. Islam and Crawford (1996, 1998) presents arguments in favour of sexual selection by explaining the variations in vocalization and display pattern. However, the evidences drawn from mitochondrial DNA phylogeny (Randi *et al.* 2000) and physiographic barriers (Ripley and Beehler 1990) strongly suggest that the Tragopans evolved by geographical barriers. It appears that these species could have evolved purely by geographic divide contributing to genetic distinctness, and later spread outwards overlapping with the range of other species.

Morphology and Taxonomic Characteristics

The Tragopans are medium sized, heavily built birds with stout and short bills, and are highly sexually dimorphic. The males have brightly colored plumage with white or grey spots. Besides the horny features, they have varying shades of bare facial skin and inflatable lappet that is used for frontal display during courtship. The females are dull brown or grey. Males have one tarsal spur, which the females lack.

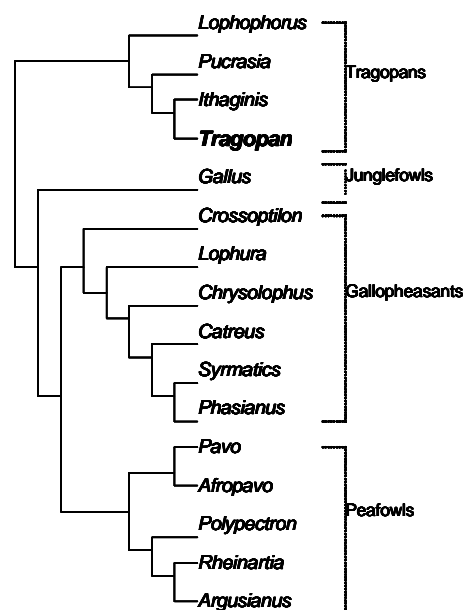


Figure 1. Phylogenetic relationships among the Pheasants (Johnsgard 1986, Kimball *et al.* 1999)



The tail moult pattern in Tragopans is centrifugal (shedding and replacement from center to outwards), which is similar to Partridges and Blood Pheasant. Tragopans are separated from other genera within Phasianidae by the absence of ocellations on tail or tail coverts, shorter wings and equal tail and wing lengths, and in females, feathers of head bushy or elongated at crown, nape or ear coverts and the primaries are same length as secondaries (Ali and Ripley 2001). Within the genera, the five species are distinguishable largely based on spotting pattern and facial skin color in males; while the females are difficult to separate between species, though there are subtle variations in the streak pattern on upper plumage (Beebe 1918 – 22, Johnsgard 1986, Ali and Ripley 2001). The following are the taxonomic keys for males to differentiate between individual species of Tragopans.

I - Undersurface spotted; bluish and reddish facial skin

- (1) *Large pearl grey spots with brown edges; bluish face* – Temminck's tragopan
- (2) *Small white spots with black edges, spotted on red; dark bluish face* – Satyr tragopan
- (3) *Small white spots with black edges, spotted on black; red face* – Western tragopan

II – Undersurface not spotted; yellowish and orange facial skin

- (4) *Reddish breast and grey underparts; yellow face* – Blyth's tragopan
a – Paler, red/crimson extending well below breast – T.b. blythii
b – Darker, red/crimson confined to a narrow band on upper breast – T.b. molesworthi
- (5) *Buffy breast and underparts; orange face* – Cabot's tragopan
a – Paler maroon-red, less extensive on back and rump; buff spots on upperparts – T.c. caboti
b – Dark maroon-red, more extensive on back and rump; yellowish-white spots on upper parts – T.c. quangxiensis

Male Tragopans weigh about 2 kg, and there are distinct variations between species and sexes. The females weigh about 1.2 kg in almost all the species. Males of Western, Satyr and Blyth's are much heavier than females and other two species (Figure 2). Cluster analysis involving body weight and other morphometry data of these birds (Table 1) revealed two distinct clusters within the Tragopans, represented by (a) Temminck-Cabot group, and (b) Satyr-Western-Blyth group (Figure 3). Interestingly, though Blyth and Cabot share similar taxonomic characters, arrangement of these species in separate groups is also supported by mitochondrial DNA phylogeny (Randi *et al.* 2000), except that the DNA study could not resolve the case of Western tragopan consistently. It is intriguing that Western and Blyth's are morphologically closer and form out group of Satyr, which shares similar vocalizations and geographical closeness with Blyth's and similar display with Temminck's (Islam and Crawford 1996, 1998). This anomaly need to be investigated further whether the variations in shared characters are an artifact of inadequate data or some other form of speciation, or a true reflection of convergence evolution (*i.e.* independently evolved similar traits as a response to adapt to similar conditions in different localities – both are typically forest species). Nevertheless, the clustering suggests that categorization and taxonomic placement of a species purely based on plumage pattern might not always be appropriate as argued by some taxonomists.

Distribution and Status

Tragopans' natural range is all along the Himalaya and adjoining hill ranges from north-eastern Pakistan, through much of India, Nepal, and Bhutan, till southeastern China, and also into northeastern Myanmar and northern Vietnam (Figure 4). Except for the Cabot's that is restricted to China, all other four species occur within the Indian limit. They are among the rare birds with low population sizes, and justifiably receive the highest attention from national as well as international conservation agencies (Table 2). All the four species found in India are listed in the Schedule I of Indian Wildlife (Protection) Act 1972. There are at least 35 sites where occurrence of these birds has contributed to declaration of 'Important Bird Areas' in India (Ishtiaq *et al.* 2000), a global effort to protect world's avifauna.

Table 1 : Morphometric measurements of Tragopans (source Madge and McGowan 2002)

Morphometry (cm*)	Western		Satyr		Blyth's		Temminck's		Cabot's	
	M	F	M	F	M	F	M	F	M	F
Length	71	60	70	58	68	59	64	58	61	50
Wing	28.0	23.8	26.5	23.0	26.3	23.8	23.5	21.5	22.2	20.0
Tail	23.5	19.5	29.0	19.5	25.0	17.2	20.5	16.8	22.0	16.1
Tarsus	9.0	6.5	9.0	6.6	8.5	7.6	7.5	7.0	65	55

* The figures are mid value of the range (min – max)

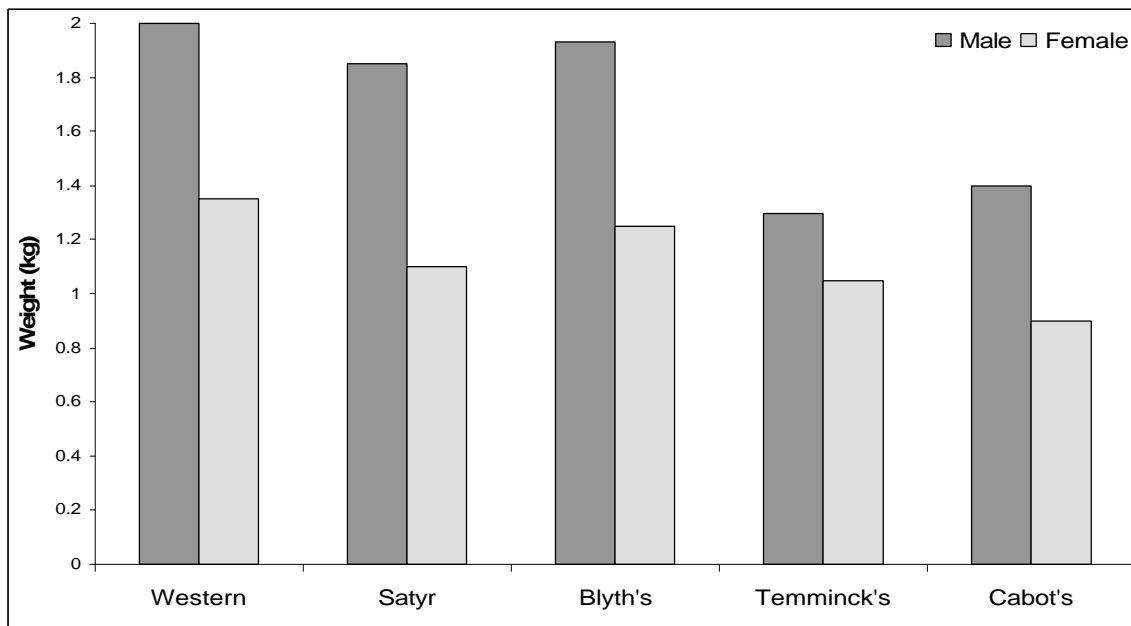


Figure 2. Body weight of male and female Tragopans (source Madge & McGowan 2002)

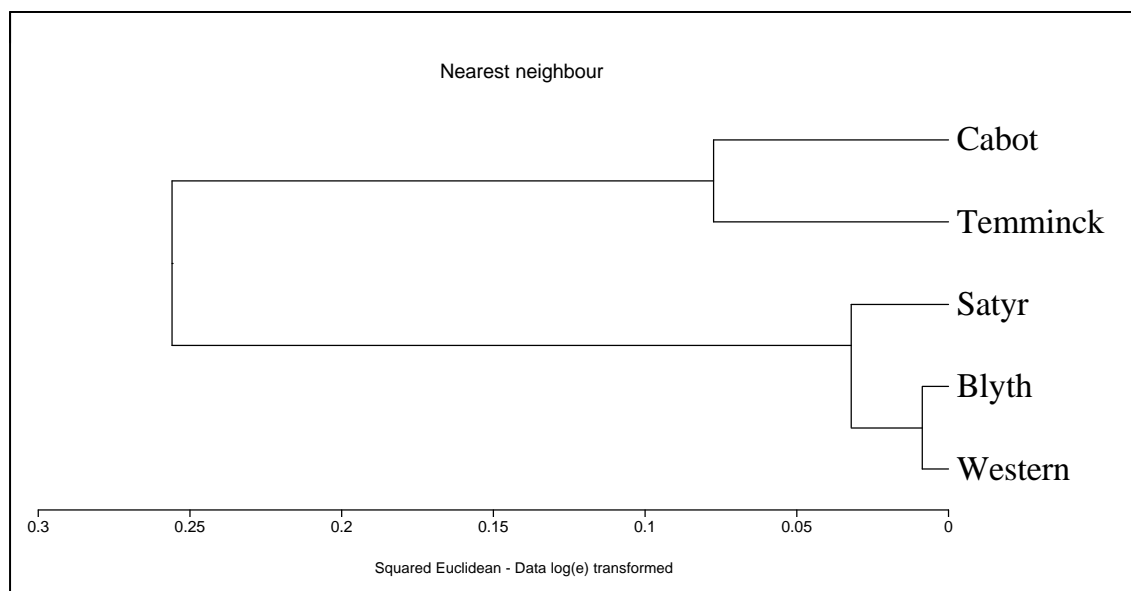


Figure 3. Clustering of Tragopan species based on morphometric characteristics



Western tragopan: It is confined to a narrow range between the Pallas valley (Kohistan district) in northern Pakistan, through Kashmir, Himachal Pradesh and the Garhwal part of Uttarakhand in India. In an arc of 700km length and 50-100km wide, the populations are in five isolated regions; (1) Pallas valley (Kohistan), (2) Kaghan/Neelum valley, (3) Kishtwar/Chamba (Kashmir/Himachal Pradesh), (4) Beas catchments primarily in Kullu valley (Himachal Pradesh), and (5) east of Sutlej River till the eastern limit in Garhwal (Birdlife International 2001). The current population estimate is only speculative, and they might number around 5,000 individuals in the world. The eastern limit was thought to be within the Govind National Park (Uttarakhand) bordering Himachal Pradesh, but it was recently confirmed *ca.* 70-80km further west in the Bhilingna valley during a 2006 survey (Ramesh *et al.* 2006). This finding corroborates with the historical record on the species distribution limit in the east (Hume and Marshall 1879). Though there are unconfirmed reports of its overlap with Satyr tragopan, credible evidences including recent field investigations suggest that these two species do not overlap, and that the Alaknanda catchments with warm valleys and uneven climatic regime perhaps contributed to huge physical separation (at least three valleys) between Western and Satyr tragopans.

Satyr tragopan: The Satyr ranges eastwards from Pindari valley (Kumaon) in Uttarakhand, through Nepal, again into India in the border District of West Bengal, Sikkim, and in Arunachal Pradesh. It is also found in much of Bhutan and in the temperate region of SE Tibet. Because of large, contiguous habitat and discovery of substantial populations in both India and Nepal, they are considered 'Lower Risk/near Threatened' species by IUCN. In India, Satyr is in three major populations; (1) Pindari/Askot valleys, (2) West Bengal/Sikkim, and (3) western Arunachal Pradesh. Interestingly, in Arunachal Pradesh and the other border areas of Tibet, Satyr possibly overlaps with Temminck's and Blyth's (Singh 1998). However, further investigations are required for placing exact position of their distribution limit.

Blyth's tragopan: Blyth's is the only species that is largely restricted to India in terms of habitat and population size. The two subspecies, *T. b. molesworthi* (western Blyth) and *T. b. blythii* (eastern Blyth, the nominate) are separated by the Brahmaputra valley. Distribution of the former is restricted to eastern Bhutan, adjacent Tibet and Arunachal Pradesh, while the latter occurs in much of Nagaland (including the adjacent Assam hills), Manipur and Mizoram, and in the border areas of Myanmar. There is a possibility that Blyth's tragopan overlaps either with Temminck's or Satyr in western Arunachal Pradesh (Suresh Kumar and Singh 2002). Like Western tragopan, it is a low density species with patchy distribution, and the world population size might be a little over 5000 individuals. Given the prevailing situation in the northeastern hill states where wild species including Blyth's are persecuted for wild meat (Hilaludin *et al.* 2005), the population size is likely to be low and declining, requiring much more conservation inputs.

Temminck's tragopan: Temminck's is relatively widely distributed species, but in India, it occurs only along the northern and eastern region of Arunachal Pradesh. Much of its populations are distributed in China, while northern Myanmar and Vitenam have small populations of this species. Due to its wide spread distribution and good population size (> 100,000), it is considered 'Least Concern' species and is not even in the list of CITES, but is included in the Schedule I of Indian Wildlife Protect Act 1972, for its rarity within the Indian limit. Temminck's overlaps with Blyth's in extreme north of Myanmar bordering China, where they possibly hybrid (Madge and McGowan 2002).

Cabot's tragopan: Cabot's is endemic to China, distributed from southeast China through north Guandong and southeast Hunan to central and northwest Fujian and south Zhejiang. The western subspecies (*T.c. guangxiensis*) overlaps slightly with Temminck's in northeast Guangxi, while the nominate eastern Cabot's (*T.c. caboti*) appears to be restricted to southeast China. It is also rare species with low population size, which is getting increasingly fragmented due to anthropogenic interventions (Deng and Zheng 2004)

Table 2. Tragopans population size and threat categories by conservation agencies.

Species	Population Size ^a	IUCN ^b	CITES ^c	WPA ^d
Western	5,000	Vulnerable	Appendix I	Schedule I
Satyr	20,000	Near Threatened	Appendix III	Schedule I
Blyth's	5,000	Vulnerable	Appendix I	Schedule I
Temminck's	100,000	Least Concerned	-	Schedule I
Cabot's	5,000	Vulnerable	Appendix I	-

a – Fuller and Garson (2000); Madge and McGowan (2002), b – IUCN (2006), c – CITES (2007), d - WPA (2007)



Habitat and Habits

The Tragopans are primarily montane birds showing strong affinity to temperate and subtropical environment. Western tragopan in particular seems to occupy relatively drier habitats than the other species that favour moisture gradients. Except for Cabot's, all the four species are resident to middle elevations, with local migration to lower areas during winter and they use diverse vegetation types (Table 3). At micro scale, they are habitat specialists, invariably associated with good undergrowth of montane bamboo, *Viburnum* sp., etc., where the habitat provides them sufficient cover from predators and also abound with quality forage such as shoots and nuts. They are often seen close to streams. Unlike most pheasants, Tragopans use trees for nesting as well as roosting.

Tragopans are secretive birds, and hard to find them in wild. However, their characteristic advertisement or territorial call (*woooooaan....woooooaan...woooooaan*) during the breeding season (April – June) and alarm call

(*wak...wak...wak*) give away their presence to a large extent. Most of the population estimate of the Tragopans comes from counting the breeding calls, as they are difficult to count otherwise. Though they are assumed to be monogamous, mating system in wild is unknown. Tragopan is mostly encountered singly or in pairs, except when they are in family parties. They have low clutch size, usually 3 – 5 eggs and incubation takes place for about three to four weeks. The most striking of the Tragopans is the male's elaborate display during courtship when it 'shows up' the elongated horns and puffed-up lappet to females.

Conservation Value and Threats

The Tragopans are among the most beautiful pheasants, and are popular with local people for the cultural value and attractive feathers (that are also used in ceremonies and rituals). Their value is clearly reflected in the 'State Bird' status for Blyth's tragopan in Nagaland and Western tragopan in Himachal Pradesh. The Western tragopan is also the mascot of IUCN/SSC/Pheasant Specialist Group

Table 3 : Elevation range and vegetation types occupied by the Tragopans.

Species	Elevation Range in metres (winter)	Forest Types ^a
Western	2,400 – 3,600m (1,800 – 3,200m)	12/C1d: Western mixed conifer 12/C1e: Moist temperate deciduous 12/C2a: Kharsu Oak (<i>Quercus semecarpifolia</i>) 12/C2b: Upper Oak - Fir 12/C3b/DS1: Montane Bamboo Brakes 13/C2b: Dry Deodar (<i>Cedrus</i>) 14/C1: Sub alpine Birch - Fir 15/C1: Birch-Rhododendron Scrub
Satyr	2,400 – 4,300m (1,800 – 3,500m)	12/C1c: Moist Deodar (<i>Cedrus</i>) 12/C1d: Western mixed conifer 12/C1e: Moist temperate deciduous 12/C2a: Kharsu Oak (<i>Quercus semecarpifolia</i>) 12/C2b: Upper Oak - Fir 12/C3b/DS1: Montane Bamboo Brakes 14/C1: Sub alpine Birch - Fir 15/C1: Birch-Rhododendron Scrub
Blyth's	1,800 – 3,300m (1,500 – 3,100)	8B/C1: East Himalayan Subtropical Wet Hill Forest 8B/C2: Khasi Subtropical Wet Hill Forest 11B/C1: East Himalayan Wet Temperate Forest 11B/C2: Naga Hills Wet Temperate Forest
Temminck's	2,200 – 3,600m (2,000 – 3,300m)	12/C1e: Moist temperate deciduous 12/C2a: Kharsu Oak (<i>Quercus semecarpifolia</i>) 12/C2b: Upper Oak - Fir 12/C3b/DS1: Montane Bamboo Brakes
Cabot's	800 – 1,400m (800 – 1,000m)	Subtropical Evergreen Deciduous, Conifer and Broadleaf Mixed Forests, dominated by Chinese Oak, Cedar and Fir.

a – Corresponds to Champion and Seth (1968) classification, except for Cabot's.



that is concerned with the conservation of world's pheasants. Tragopans are the most sought after species for private aviaries and public exhibits. It is an evolutionarily significant group, being the early species in the diversification of pheasants, and they are often cited as examples for explaining the mode of speciation in wild species. Given their strong association for undergrowth and extended forest patches to suit their home range (Young *et al.* 1991, Ramesh *et al.* 2002), they could possibly be used as a candidate species to monitor habitat conditions at local as well as at large scales. India's responsibility to Tragopans stem from the position that it is the stronghold for both the globally threatened species - Western and Blyth's tragopans containing over 60% of the former, and over 80% of the latter. Significant populations of Satyr occur in three distinct localities (Uttarakhand, Sikkim/West Bengal, and Arunachal Pradesh) and Temminck's is rare, known only from the border areas of Arunachal Pradesh. Tragopans certainly qualify to be on the top of conservation agenda in the Indian Himalaya.

Threats to Tragopans vary from large scale habitat conversion, forestry operations, poaching to disturbance from collection of minor forest produce. Western tragopan was found to be affected by poaching, disturbance during breeding seasons by forest produce collectors, grazing pressures and habitat fragmentation (Ramesh 2003, Nawaz 2005). Loss of winter habitat in lower elevation areas for developmental projects and expansion of agriculture likely disturb population size even in the best habitats. Satyr tragopan face threats from excessive hunting, habitat loss and degradation from forestry operations, fuel wood collection etc. In many localities, the prime habitat is extensively used by sheep and goats during breeding season, which might have repercussion on the population status of the species. Blyth's and Temminck's are largely affected by poaching, deforestation and habitat alterations for agriculture (Birdlife International 2001), while Cabot's are suffering from habitat fragmentation (Deng and Zheng 2004) and breeding failure due to predation pressure (Zhang and Zheng 2006).

Research and Management Requirements

All the species of Tragopans have received substantial research focus as compared to the other pheasant species of Asia. Intensive ecological research projects have been carried out on Western tragopan both in India (Ramesh 2003) as well as in Pakistan (Islam 1985). Though Nepal contains large proportion of its habitat and population size, the only intensive research on Satyr tragopan was from Singhalila National Park, Darjeeling in India (Khaling 1998). Attempts have also been made to understand distribution and habitat use of Blyth's and Temminck's tragopans in India (Ghose *et al.* 2000, Ghose 2001), while

Chinese have made sustained efforts to understand the ecology and behaviour of Temminck's and Cabot's tragopan over the past 25 years (Zhang and Zheng 2006). A significant number of publications on the Temminck's tragopan are confined to Chinese literature. However, the aspects of breeding biology and feeding habits that are critical for management intervention is grossly lacking for all the species, specifically in India. The population estimates needs to be updated with appropriate sampling protocol, which could be guided by the earlier studies on the ecology and movement pattern of these species. With the populations getting fragmented in all the species, potentially increasing extinction probability at least locally, it would be important to understand different genetic populations, and the variables contributing to the current pattern and the future course.

The current management strategy largely focusing on Protected Areas (PA) is insufficient; as there are substantial populations of these species exist outside PA network, and these populations may be safeguarded by declaring some of their ranges as Conservation / Community Reserves. Winter is the most crucial period as these birds descend to certain lower areas, making them vulnerable to poaching/hunting. Therefore, efforts need to be targeted at winter habitats particularly during the period of high snowfall. There is also a need for establishing population monitoring system and viability analysis for all the species, at least in the representative localities. Local education and research institutions could be involved in this scientific exercise. It is important to maintain some captive populations capable of survival and multiplication in the wild, and in this direction, the recent event of successful breeding and parent rearing of Western tragopan at the Sarahan Pheasantry in Himachal Pradesh is encouraging, especially when nowhere else in the world captive population of this species exists.

Concluding Remarks

The Tragopans are not only rare in terms of the brilliantly patterned morphology and population size, but also for the challenges they present to scientific queries and for managing their populations. About their evolution, though there are plausible evidences in favour of speciation by way of geographic barrier, conflicting explanations still persists with respect to plumage pattern and coloration, vocalization, and display behaviour, and it is hard to explain the species overlap in some areas. They are highly secretive birds, and the current global population estimates reported for all these species in the literature are from limited knowledge based on call counts of males, later extrapolated to include females with an assumption that male: female ratio is 1:1. These estimates are contested on the ground that population estimates based on 1:1 sex ratio



assumption could yield an overestimate since the birds populations are naturally skewed towards males (Islam and Crawford 1993, Donald 2007). It is also possible that the estimates for some species are under reported because of insufficient field sampling in the mountainous terrain (Birdlife International 2001). Nevertheless, given their special habitat needs, low habitat availability, poor clutch size (3 – 5) and long duration of two years for sexual maturity, natural populations of these birds are unlikely to be very high. Fortuitously, the rarity works to their advantage invoking enhanced concerns from both local and global conservation agencies. Further, with appropriate extension activities highlighting their unique features and evolutionary significance, Tragopans would serve as the 'Flagship Species' influencing greater public participation towards wildlife conservation specifically in the temperate region of the Himalaya and the adjoining hill ranges.

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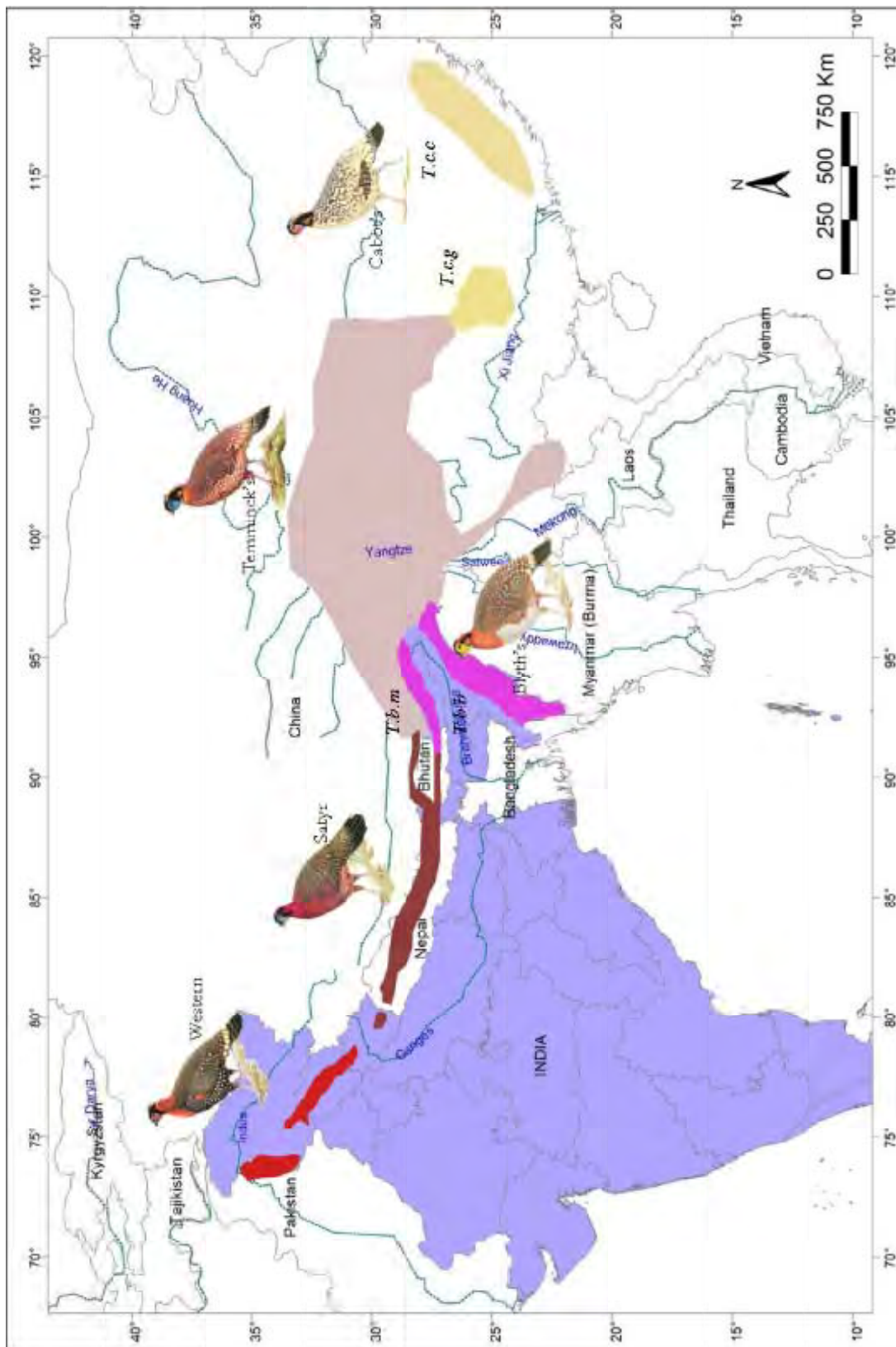


Figure 4. Global Distribution of Tragopans, including subspecies





7.0 The Himalayan Quail – Extinct or Evasive?

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Introduction

The Himalayan Quail *Ophrysia superciliosa*, is one of the rarest Galliformes species in the world. Despite several surveys, this species has not been recorded with certainty since 1876, and it may have been severely impacted by habitat degradation and hunting. However, it probably remains extant, because thorough surveys are still required; the species may be difficult to detect (favouring dense grass and being reluctant to fly). In addition there is a recent set of possible sightings around Nainital in 2003. Any remaining population is likely to be tiny, and for these reasons it is treated as Critically Endangered (BirdLife International. 2004, IUCN 2006; BirdLife International 2007).

This species is known to the mankind through a dozen specimens procured from Jharipani, Banog and Bhadraraj (behind Mussorie) and Sher Ka Danda (Nainital). All these areas are located in the lower Western Himalayan ranges in the state of Uttarakhand in India. Most of these specimens were shot during winter (except once) from the steep grasslands and scrub openings on south facing slope crests between 1,650 and 2,400 m elevation range in the forests of lower Western Himalayan region of Uttarakhand (Ali and Ripley 1987; Shafiq 1997, Shafiq *et al.* 2000; Fuller *et al.* 2000).

Its current distribution is unknown. Between 1945 and 1950 there were apparently reliable reports of this species being shot in east Kumaon near Lohagat village and from the Dailekh district of Nepal (Ripley 1952), and there is another putative sighting near Suwakholi in the Mussoorie hills by Negi (1992) who reported encountering coveys of birds on two occasions in September 1984. However, the descriptions of these birds were very vague and all twentieth century records remain unsubstantiated (Collar *et al.* 2001).

All that is known about the natural history of Himalayan Quail is its size, which is reported to be large for a Quail. It had a relatively longer tail; conspicuous red bill and legs. Bill was thick and short with upper mandible overhanging the lower; legs were short and usually armed

with one or more pointed spurs in male; hallux was always present, claws were short, blunt and very strong for scratching food from the ground. Wings were short and rounded; flight was swift and strong but incapable to cover long distances. Generally, encountered in covey of 6-10 heads, it was extremely elusive, never flying except when almost stepped on.

Status

Field investigations during mid 19th century indicated that Himalayan Quail may have been relatively common, but it was reported as rare by the late 1800s. The habitat of Himalayan Quail probably bore some similarities to the habitat of the Cheer Pheasant *Catreus wallichii* which is patchy, suggesting that these birds were probably never present in large numbers (Kaul *et al.* 1998).

The lack of records for over a century, suggests that this species may have become extinct. The unconfirmed reports of its sighting, recent literature reviews, and field investigations, have however kept alive the hope that small populations may still survive in some areas in the lower or middle Himalayan range between Nainital and Mussorie (Hilaluddin and Kaul 2002). There has been a lack of long-term and dedicated surveys to rediscover the Himalayan Quail which makes it difficult to pronounce this species as extinct. It is likely that this species is surviving somewhere in its historical distribution range but has not been located so far for want of dedicated survey effort? Despite its "Critical" status, very few efforts have been made to locate this species within its natural range. In the past, only few attempts were made by Sankaran (1990), Reiger and Waltzhthony (1992), Kaul *et al.* (1998), Hilaluddin *et al.* (2002) and Kalsi *et al.* (2004). The last field effort to locate the elusive Himalayan Quail used satellite data and geographical information system approach (Hilaluddin *et al.* 2002; Kalsi *et al.* 2004). However, none of these surveys were able to establish presence of any Himalayan Quail populations but made some useful pointers.



Habitat and distribution

According to Mackinnon (in Hume and Marshall, 1879-81), the Himalayan Quail was found in long "seed grasses" on the steep slopes of hills, and was made to fly only when flushed by a dog, or trod upon. This is perhaps the only description available and most writers have quoted Hume and Marshall (1879-81) thereafter. However, many people have made deductions about the habitat of the Himalayan Quail.

Baker (1928) thought that the Himalayan Quail occurred in groups of five to ten individuals that lived in high grass where they fed on fallen seeds and could rarely be seen. In the afternoon, they descended into sheltered hollows, sometimes occupying very steep slopes with patches of brushwood. Grant (1896) and Finn (1911) also thought that this bird occurred in coveys of six to ten, and kept close to cover in grass or brushwood. Greenway (1967) was of the opinion that the Himalayan Quail was an extremely shy and retiring bird, that inhabited steep grassy slopes and could be seen only when flushed.

The Himalayan Quail apparently preferred steep slopes with small growing vegetation; as such features allow a flushing bird to escape ground vicinity without any great navigational ability (Reiger and Waltzthony 1990). According to Ali (1977) the Himalayan Quail inhabited long grass and was a skulker, found on steep rugged hillsides cut by wooded and/or stony valleys. He further said that most specimens were obtained during or soon after November when the grass on the open hillsides was taller and provides good cover. Ali (1977) felt that habitat requirements of these birds were very much similar to Cheer Pheasant *Catreus wallichi* and steep slopes, grass and bush vegetation made it difficult to find these small birds.

Kaul (1992) drew a comparison between the Cheer Pheasant (*Catreus wallichi*) and the Himalayan Quail, based on the habitat descriptions of the two species which appeared to be quite similar in literature (Ali and Ripley 1987). Kaul (1992) was of the opinion that if the habitat of the Himalayan Quail was what has been presented in the literature, then the rather limited habitat of steep and scrubby slopes, interspersed with precipitous cliffs between 1,000m and 3,000m altitude, must impose severe restrictions on the distribution of both these species. As open grassy and scrubby areas do not form large contiguous tracts in the Western Himalaya, Cheer Pheasant has always been patchily distributed across its range with populations limited by the availability of suitable habitat. If the Himalayan Quail was a bird of such specialized habitat and given that such areas are not very extant, most populations were probably small and vulnerable to "local extinctions". In the event of

identification of areas with Himalayan Quail, and if such areas have habitats similar to ones occupied by Cheer Pheasant, then there is a likelihood that it will not be very large in population (Kaul 1992).

Das (1995) believed that the Himalayan Quail was a shy, skulking bird that lived only in very thick undergrowth, heavy tangles of tall grass, hill bamboo and bushes, where it scurried about like a rodent, always under some form of overhead cover. He opined that the Himalayan Quail did not inhabit slopes with a combination of bushes and tall grass (habitat of Cheer Pheasant), but probably lived in adjacent large patches of thick scrub, consisting of bushes, grass and hill-bamboo on slopes, valley bottoms or hollows. His assumptions were based on the colouration and habits of the bird as described in literature.

As admitted by earlier authors, the Himalayan Quail used areas with "seeding grass" quite extensively (Hume and Marshall, 1879-1881). Seeding of grass in the Western Himalayas occurs only during the months of November and early December which also coincided with the period when most Himalayan Quails were shot. Many galliformes species such as Painted Francolin (*Francolinus pictus pallidus*), Cheer Pheasant and White-crested Kalij (*Lophura leucomelana hamiltonii*) feed on grass seeds when available. Therefore, it is quite likely that Himalayan Quail used to visit areas of "seeding grass" for the seed, and were shot there. It would be interesting to know whether the Himalayan Quail continued to stay in such areas once winter approached and the grass has dried? or did they migrate elsewhere? An answer to this question could provide vital clues about which areas that one could consider for a detailed search.. It is likely that the Himalayan Quail spent the winter in either of these areas or probably at lower altitudes in case of bad weather. However, it is also possible that the Himalayan Quail did not spend the whole year in the above mentioned areas, because they would have been located in these habitats otherwise. There has been only one report of a covey (a family of five) that was shot in Jaripani during June, all other cases, the birds were found in winter in the earlier described habitats of tall grass.

In spring, most of the grass was dead and even with fresh shoots sprouting; the grassland by itself becomes incapable of providing adequate shelter to a bird of the size of Himalayan Quail. Therefore, either the bird was migratory and moved to higher altitudes during summer, higher than where, it was seen or shot or it was resident and used other areas, close to these grassy open patches for the rest of the year.

Let us consider a situation where a Himalayan Quail was shot near Sher-ka-Danda in Nainital and another one was



seen in the vicinity (Carwithen 1879). Sher-ka-Danda, as it is now, is a small hillock on the north-eastern side of Nainital. This hillock has a small open grassy patch on the top and the rest of the area, which is rather small, is scrubby followed by extant wooded forest. Open grassy areas are generally created by human pressures such as removal of trees, shrubs and by some form of continual disturbance (grazing, lopping, slashing of shrubs). A century ago, such pressures on Sher-ka-Danda would have been substantially less than what they are now because human population in Nainital was negligible then. Thus, Sher-ka-Danda probably had a very small patch of "seed grass", smaller than what exists there now, and which the Himalayan Quail used a century ago where they were subsequently shot in 1876. It is difficult therefore, to visualize that a species could thrive in such a small habitat. They probably used this particular habitat for only a part of the year when it provided re-sources for the bird (grass seeds, other food material and also sun-shine) and moved somewhere else for the rest of the year. The immediate vicinity of the grassland then was the scrubland and oak forest. Sher-ka-Danda is the highest point of the hill and a species could only move downwards from there, into the oak or scrub habitat close to these grassy patches, or migrate on foot to cross ranges and on to the high mountains in the inner line.

Extinct or Elusive?

Reiger and Waltzthony (1990) made the first comprehensive effort to re-discover the Himalayan Quail and put forward two models for their extinction. Both the models suggest that the Himalayan Quail was a bird which originally lived at low altitudes, even as low as 400m. They were driven to higher altitudes by the increase in human population at low altitudes (due to their technophobic behaviour). The second independent model suggested that the reason for the Himalayan Quail to have moved to higher altitudes was the shifting of vegetation belts from lower altitudes to higher altitudes due to change in temperature following the glaciations in the Pleistocene Age. According to these two models, the mountain Quail kept moving to higher altitudes, and as the hills of the lesser Himalayas do not have many peaks above 2,000 m, the Himalayan Quail formed island populations at these peaks, which later became extinct with increased human pressures.

For a species which has not been seen for more than 100 years it could be safely categorised as 'possibly extinct'. However, what makes Himalayan Quail enigmatic is the fact that even in the last survey efforts to locate Himalayan Quail, the local villagers identified the species from the pictures and descriptions and said that the birds close (?) to Himalayan Quail descriptions did occur in their areas and could be seen. However, no direct or indirect evidences were found

after intensive surveys in these locations (Kalsi *et al.* 2004). It is important to know whether appropriate methods or techniques were used in these surveys for the detection of a bird with cryptic colouration and secretive behaviour which lived in a vast area of dense grass. BirdLife International (2004) suggested considering that small population(s) of the species may exist in some remote area, a well-planned survey of apparently suitable habitat (including a revisiting of the sites from which the species was known) needed to be instituted in the lower Himalayan ranges through the use of remote sensing methods and satellite data. Once potential areas were located, ground surveys needed to be organized by a team of competent ornithologists. In an effort to locate the birds, suitable survey techniques should be adopted. A combination of flushing (e.g. trained dogs) and trapping techniques (e.g. grain-baited photo-trap stations) over a few seasons could be employed in selected localities. A systematic programme of questioning of local *shikaris* (hunters), using recent illustrations, was also needed, and a poster-plea could be made throughout the prospective range of this species in Uttarakhand. If the species indeed shared habitat with the Cheer Pheasant (Kaul 1992), surveys should perhaps be targeted at localities for the pheasant nearest to the known localities for the Quail. The call count method employed successfully for the detection and survey of a number of galliformes species cannot be used for the Himalayan Quail since nobody knows about its calls. Survey by Kalsi *et al.* (2004) had short-listed potential sites based on satellite imagery data and carried out intensive field surveys and interviews with local villagers, including old *shikaris* and poster plea.

The past evidences and records weigh heavily in favour of the hypothesis that Himalayan Quail is extinct. This hypothesis is reinforced by three factors – the species has not been seen for over a century, it was always in small numbers and patchily distributed, and the habitats in areas where it was reported from have suffered from heavy human pressures.

Out of the above survey techniques, flushing with trained dogs and grain-baited camera-trap stations remain to be used for the detection of Himalayan Quail. Therefore, before concluding that Himalayan Quail is 'extinct', it will be necessary to conduct a series of dedicated and well-planned surveys at locations short listed by Hilaluddin *et al.* (2002) and Kalsi *et al.* (2004) who had used satellite data. At these locations, intensive surveys should be conducted with trained dogs and grain-baited camera-trap stations. Molecular genetic analysis of feathers / egg shells collected from field and that are suspected to be of the Himalayan Quail needs to be carried out. Until the completion of detailed field surveys as suggested above, we may consider that the Himalayan Quail is elusive and evasive.



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8.0 Biogeographical Analysis of Galliformes Distribution in India and Pheasants in the Himalayan Protected Areas

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Introduction

A biogeographical analysis of distribution patterns of flora and fauna yields a precise picture of faunal similarity of landscape units. They aid inferences about historical dispersal, biogeographical affinities, and biogeographical zonation of a region. We analyze the geographical distribution of Indian Galliformes in this paper in an attempt to study their biogeographical affinities and patterns.

Methods

The entire country was divided into 35 landscape units on the basis of geomorphology and eco-climate, as follows:

Western Trans-Himalaya: Trans-Himalayan Tibetan facies in the west, including Ladakh, Lahaul & Spiti, and Kinnaur. Also includes the scarce and isolated Trans-Himalayan stretches of Uttarakhand

Eastern Trans-Himalaya: Trans-Himalayan Tibetan facies in the east, including that of Sikkim and Arunachal Pradesh

Kashmir Valley: The oval-shaped upland plain of Kashmir Valley (134 X 40 km) nestled among the Kashmir Himalaya (Pir Panjal)

North-western Himalaya: The Great Himalaya in north-west India (Kashmir & Himachal Pradesh), excluding the Tibetan facies

Western Himalaya: The Himalaya in the west comprising Garhwal & Kumaon in Uttarakhand, excluding the Tibetan facies

Shiwalik Hills: The Shiwalik Range and associated foothills in Kashmir (between Pir Panjal Range and Chenab river) and then disjunctly from Himachal Pradesh (Kangra district), Uttarakhand, east to Nepal

Eastern Himalaya: The Himalaya in the east (Bhutan & Arunachal Pradesh), excluding the Tibetan facies

North-eastern Hills: The hills in north-east India, south of Brahmaputra River

Punjab Plains: The semi-arid plains of Punjab, Haryana, and Delhi

Upper Gangetic Plains: The Upper Gangetic Plains of Uttar Pradesh including terai, bhabar, and floodplains of Ganges and its tributaries

Lower Gangetic Plains: The Lower Gangetic Plains of Bihar and West Bengal including terai and bhabar

Assam Plains: Assam floodplains along the Brahmaputra River

Gujarat-Rajputana: The Gujarat-Rajputana region, including north-western Gujarat, Chambal valley, Malwa and Shivpuri Plateaus in Madhya Pradesh and Aravallis of southern Rajasthan

Kathiawar Peninsula: The Kathiawar peninsula of Gujarat (including Saurashtra)

Thar Desert: The Great Thar Desert of India in Rajasthan

Kutch: The Great and Little Rann of Kutch in Gujarat

Satpura Range: The Satpura Ranges of the Central Indian Highlands, almost entirely south of Narmada River. The range includes (from west to east) Nimar Hills, Gawilgarh Hills, Betul Plateau, Pachmarhi Plateau, Mahadeo Hills, and Maikal Ranges

Vindhya Range: The Vindhya Ranges of the Central Indian Highlands, north of Narmada River. The range includes (from west to east) Jhabua hills, Vindhyan hills south of Malwa Plateau, Sagar-Damoh Plateau, Bhandar Range, and Vindhyan Scarplands

Northern Eastern Ghats: The northern parts of Eastern Ghats, including Chhota-Nagpur Plateau, Eastern Highlands



of Chhattisgarh, and hills of Orissa and north Andhra Pradesh (south to Krishna River)

Southern Eastern Ghats: The southern parts of Eastern Ghats, including the hills of southern Karnataka, southern Andhra Pradesh, and hills of north and western Tamil Nadu

Deccan Plateau: The 'cotton country' of the Deccan Plateau which includes the semi-arid plains and scrublands in Maharashtra (central and western including Vidarbha), Madhya Pradesh (lowlands surrounding the Satpuras and Vindhyas), Chhattisgarh (Mahanadi Basin), northern Karnataka, and north-western Andhra Pradesh

Eastern Plains: The plains of Eastern India lying between the Eastern Ghats and East Coast in Orissa (esp. Mahanadi Basin) and north-eastern Andhra Pradesh south to Godavari delta

Coromandel Plains: The Coromandel Plains of Tamil Nadu and southern Andhra Pradesh (south of Godavari river)

Malabar Plains: The narrow linear stretch of plains sandwiched between the Malabar and Konkan parts of the West Coast and the Western Ghats (Maharashtra, Goa, Karnataka, and Kerala)

Southern Western Ghats: The southern stretches of Western Ghats (south of Palghat Gap)

Central Western Ghats: The central part of Western Ghats [north of Palghat Gap -from Nilgiris north to Uttar Kannada (Dharwar dt in Karnataka)]

Northern Western Ghats: The northern stretches of Western Ghats (Maharashtra and Gujarat).

Gujarat Coast: The coastline of Gujarat State (including Kutch and Kathiawar coasts south to Surat)

Konkan Coast: The Konkan Coast of Maharashtra and Goa, south to Karwar in Karnataka

Malabar Coast: The Malabar Coast from Karwar in Karnataka through Kerala, south to Kanyakumari in Tamil Nadu

Coromandel Coast: The southern stretch of East Coast from Visakhapatnam south to Kanyakumari in Tamil Nadu

Sundarban and Orissa Coast: The northern stretch of East Coast from Bengal (Sundarbans) and Orissa down to Visakhapatnam in Andhra Pradesh

Andamans: Andaman islands

Nicobars: Nicobar islands

Lakshadweeps: Lakshadweep islands

Information on presence/absence of Galliformes species in each of these landscape units were collated from various published sources mainly Ali and Ripley (1983), Grimmett *et al.* (1998), Kazmierczak and van Perlo (2000), and Rasmussen and Anderton (2005). Apart from these general references, a large number of regional works have also been consulted. although 45 species of Galliformes are recorded in India, we have considered 43 species for the analysis (Table 1). As the Nicobar Megapode is a distant relative of Galliformes, we have not included in the analysis as it has independent biogeographical history. Similarly, the Japanese Quail which is a winter visitor in small numbers in some parts of northeast India has not been included in the analysis. As very few galliformes species occur in Andaman or Lakshadweep islands, these two landscape units have been removed from final analysis.

The distribution matrix of 43 species of Galliformes and 33 landscape units was developed and subjected to hierarchical cluster analysis to derive similarity matrices of land units in terms of their bird species composition. As the data was binary in nature (i.e., presence / absence of species), Sørensen's distance measure was used in conjunction with flexible beta linkage ($\alpha = -0.25$) to extract the clusters. This combinatorial strategy is often recommended as it turns out to be the most space-conserving clustering algorithm for binary data (McCune & Bruce, 2002). All the analyses were done using the statistical program PC-ORD Version 4.0 (McCune & Mefford, 1999).

Biogeographic classification of Galliformes in India

Out of the 43 species of Galliformes in India, 13 species (c. 30 %) are endemic to the Indian Subcontinent, with four genera *Perdicula*, *Galloperdix*, *Catreus*, and *Ophrysia* being confined to the Subcontinent. The highest diversity of Galliformes is to be seen in the Himalayas, while the Andaman & Nicobar islands have only one resident species (Blue-breasted Quail in Nicobars). Biogeographically, a large number of Galliformes genera found in India are Oriental in affinities, with some showing Indo-Chinese links and others Indo-Malayan origins. However, species exclusive to the Trans-Himalaya are distinctly Palearctic in nature. One genus (*Francolinus*) is of African origin. There are seven endemic and eight restricted-range species within Indian limits. See Table 2 for a list of endemic and restricted range species of Galliformes in India.

**Table 1 :** List of Galliformes species found in India and their biogeographic affinities

S.No.	Common name	Scientific name	Biogeographic affinity*
1	Snow Partridge	<i>Lerwa lerwa</i>	Palearctic
2	Tibetan Snowcock	<i>Tetraogallus tibetanus</i>	Palearctic (Indo-Tibetan)
3	Himalayan Snowcock	<i>Tetraogallus himalayensis</i>	Palearctic (Indo-Chinese)
4	Buff-throated Partridge	<i>Tetraophasis szechenyii</i>	Palearctic (Indo-Chinese)
5	Chukar	<i>Alectoris chukar</i>	Palearctic
6	Black Francolin	<i>Francolinus francolinus</i>	Ethiopian (Afro-tropical)
7	Painted Francolin	<i>Francolinus pictus</i>	Ethiopian (Afro-tropical)
8	Chinese Francolin	<i>Francolinus pintadeanus</i>	Ethiopian (Afro-tropical)
9	Grey Francolin	<i>Francolinus pondicerianus</i>	Ethiopian (Afro-tropical)
10	Swamp Francolin	<i>Francolinus gularis</i>	Ethiopian (Afro-tropical)
11	Tibetan Partridge	<i>Perdix hodgsoniae</i>	Palearctic
12	Common Quail	<i>Coturnix coturnix</i>	Uncertain (Palearctic?)
13	Rain Quail	<i>Coturnix coromandelica</i>	Uncertain (Palearctic?)
14	Blue-breasted Quail	<i>Coturnix chinensis</i>	Uncertain (Palearctic?)
15	Jungle Bush Quail	<i>Perdica asiatica</i>	Oriental (Indian)
16	Rock Bush Quail	<i>Perdica argoondah</i>	Oriental (Indian)
17	Painted Bush Quail	<i>Perdica erythrorhyncha</i>	Oriental (Indian)
18	Manipur Bush Quail	<i>Perdica manipurensis</i>	Oriental (Indian)
19	Hill Partridge	<i>Arborophila torqueola</i>	Oriental (Indo-Malayan)
20	Rufous-throated Partridge	<i>Arborophila rufogularis</i>	Oriental (Indo-Malayan)
21	White-cheeked Partridge	<i>Arborophila atrogularis</i>	Oriental (Indo-Malayan)
22	Chestnut-breasted Partridge	<i>Arborophila mandellii</i>	Oriental (Indo-Malayan)
23	Mountain Bamboo Partridge	<i>Bambusicola fytchii</i>	Oriental (Indo-Chinese)
24	Red Spurfowl	<i>Galloperdix spadicea</i>	Oriental (Indian)
25	Painted Spurfowl	<i>Galloperdix lunulata</i>	Oriental (Indian)
26	Himalayan Quail	<i>Ophrysia superciliosa</i>	Oriental (Himalayan)
27	Blood Pheasant	<i>Ithaginis cruentus</i>	Oriental (Indo-Chinese)
28	Western Tragopan	<i>Tragopan melanocephalus</i>	Oriental (Indo-Chinese)
29	Satyr Tragopan	<i>Tragopan satyra</i>	Oriental (Indo-Chinese)
30	Blyth's Tragopan	<i>Tragopan blythii</i>	Oriental (Indo-Chinese)
31	Temminck's Tragopan	<i>Tragopan temminckii</i>	Oriental (Indo-Chinese)
32	Koklass Pheasant	<i>Pucrasia macrolopha</i>	Palearctic (Indo-Chinese)
33	Himalayan Monal	<i>Lophophorus impejanus</i>	Oriental (Indo-Chinese)
34	Sclater's Monal	<i>Lophophorus sclateri</i>	Oriental (Indo-Chinese)
35	Red Junglefowl	<i>Gallus gallus</i>	Oriental (Indo-Malayan)
36	Grey Junglefowl	<i>Gallus sonneratii</i>	Oriental (Indo-Malayan)
37	Kalij Pheasant	<i>Lophura leucomelanos</i>	Oriental (Indo-Malayan)
38	Tibetan Eared Pheasant	<i>Crossoptilon harmani</i>	Palearctic (Indo-Chinese)
39	Cheer Pheasant	<i>Catreus wallichii</i>	Oriental (Himalayan)
40	Mrs Hume's Pheasant	<i>Symycticus humiae</i>	Palearctic (Indo-Chinese)
41	Grey Peacock Pheasant	<i>Polyplectron bicalcaratum</i>	Oriental (Indo-Malayan)
42	Indian Peafowl	<i>Pavo cristatus</i>	Oriental (Indo-Malayan)
43	Green Peafowl	<i>Pavo muticus</i>	Oriental (Indo-Malayan)

* Biogeographic affinity is given here at the level of genera and is inferred on the basis of degree of speciation, radiation, and endemism within the genus



The cluster dendrogram yielded five distinct Galliformes assemblages with respect to their geographical distribution (Figure 1). These assemblages can be

interpreted as 'signature species' of West Himalaya, Eastern Himalaya, North-eastern Hills, Trans-Himalaya, and Peninsular India. See Table 3 for a summary of these assemblages.

Table 2 : List of Galliformes species which are endemic to India and species that have very narrow distribution ranges (i.e., < 50,000 km²).

Species endemic to India	Restricted-range species
Nicobar Megapode	Nicobar Megapode
Rock Bush Quail	Manipur Bush Quail
Painted Bush Quail	Chestnut-breasted Partridge
Red Spurfowl	Himalayan Quail
Painted Spurfowl	Western Tragopan
Himalayan Quail	Blyth's Tragopan
Grey Junglefowl	Sclater's Monal
	Cheer Pheasant

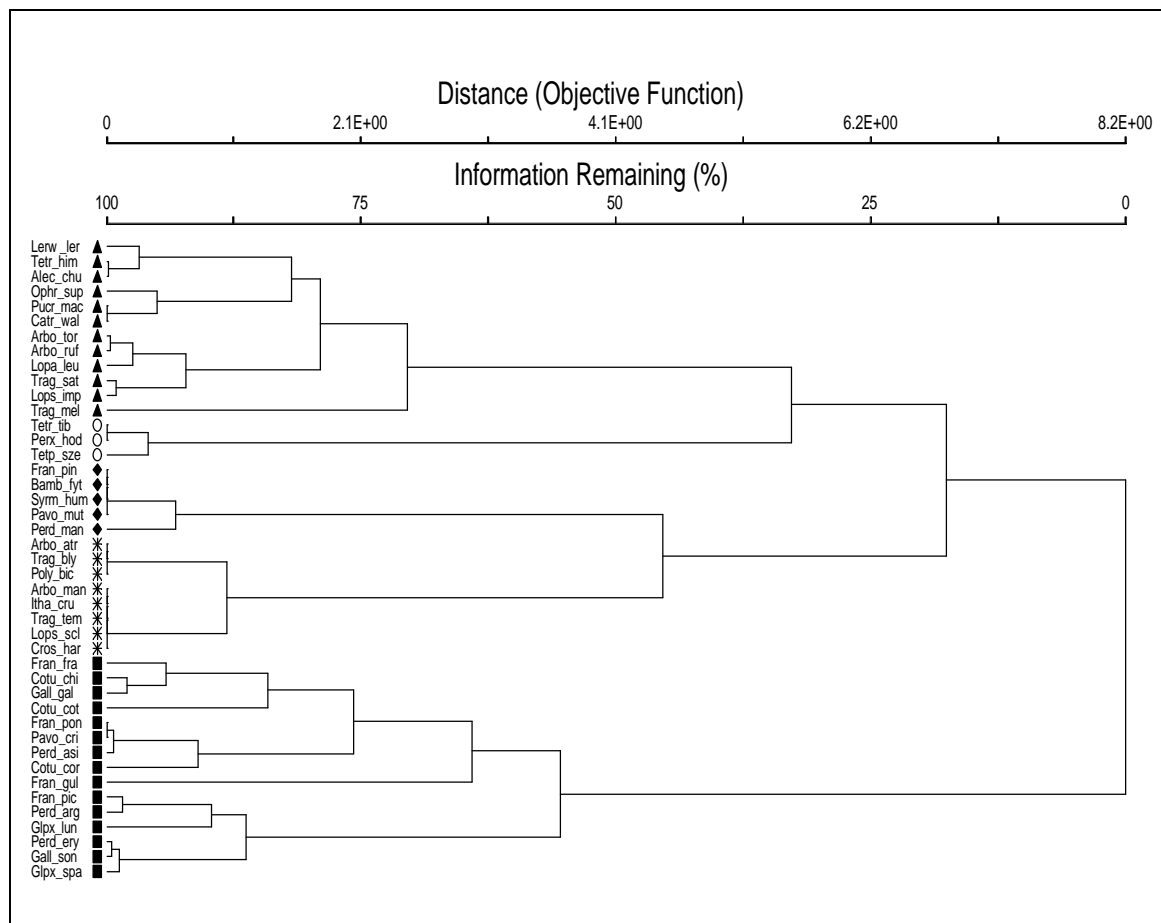


Figure 1. Dendrogram showing the five distinct Galliformes assemblages of India.



Table 3 : Species composition of Galliformes assemblages of India as identified by the cluster analysis

S. No.	Assemblage	Species Composition
I	Trans-Himalaya	Tibetan Snowcock
		Tibetan Partridge
		Buff-throated Partridge
II	Western Himalaya	Snow Partridge
		Himalayan Snowcock
		Chukar Partridge
		Himalayan Quail
		Koklass Pheasant
		Cheer Pheasant
		Hill Partridge
		Rufous-throated Partridge
		Kalij Pheasant
		Satyr Tragopan
		Himalayan Monal
		Western Tragopan
III	Eastern Himalaya	White-cheeked Partridge
		Blyth's Tragopan
		Grey Peacock Pheasant
		Chestnut-breasted Partridge
		Blood Pheasant
		Temminck's Tragopan
		Sclater's Monal
		Tibetan Eared Pheasant
IV	North-eastern Hills	Chinese Francolin
		Mountain Bamboo Partridge
		Mrs Hume's Pheasant
		Green Peafowl
		Manipur Bush Quail
V	Peninsular India	Grey Francolin
		Black Francolin
		Painted Francolin
		Swamp Francolin
		Blue-breasted Quail
		Common Quail
		Rain Quail
		Red Junglefowl
		Grey Junglefowl
		Jungle Bush Quail
		Rock Bush Quail
		Painted Bush Quail
		Red Spurfowl
		Painted Spurfowl



Key Findings with respect to biogeographical analysis of Galliformes in India

The following are some of the key observations made out of biogeographical analysis of distribution of breeding Galliformes in India:

- A majority of Galliformes in India are either Indo-Chinese or Indo-Malayan in their zoogeographical affinity.
- Francolins are probably the only Galliformes taxa that are African in origin, in contrast to the general trend in Indian avifauna.
- Four genera (*Perdica*, *Galloperdix*, *Catreus*, and *Ophrysia*) are exclusive to the Indian Subcontinent, with *Perdica* (Bush Quails) and *Galloperdix* (Spurfowls) showing a moderate degree of speciation and radiation.
- Only one species (*i.e.*, Blue-breasted Quail) of Galliformes is found in Indian islands (confined to Nicobars), giving support to dispersal vis-à-vis vicariance events.
- There are seven species of Galliformes endemic to India and eight restricted-range species.
- The biogeographical analysis yields FIVE major Galliformes assemblages within India, *i.e.*, Western Himalaya, Eastern Himalaya, North-eastern Hills, Trans-Himalaya, and Peninsular India.

Pheasants in Himalayan Protected Areas

There is no detailed information on the distribution of the pheasants in the Protected Areas (PAs) of India. However, we have tried to compile the maximum information regarding pheasants in Indian Himalayas with the help of literature, ornithologists and bird watchers of the region. We believe that the information regarding the distribution of pheasants in the Eastern Himalaya and the northeast India is incomplete in this compilation. Of the 17 species of pheasants that occur in India, 16

species are found in the Himalayan region. Grey Junglefowl is the only one that does not occur in the Himalaya. There are about 99 PAs (which includes five proposed PAs) in the Himalayas covering approximately 41,597 km² (approximately 7.9% of the region) in which the pheasants occur in all but Trans-Himalaya. These include; 92 PAs in the Himalayan zone, 4 in the Gangetic Plain, and 13 in northeast India. The Central Himalayan province (2C) has the highest percentage of PA coverage while the province of North-East Hills (9B) has the lowest PA coverage (Table 4).

Protected Area Coverage for Pheasants in Himalayas

An analysis of area covered under the PA network in each biogeographic zone (*i.e.*, area available for conservation of pheasants) reveals that the pheasants are present almost all over Himalayas except Trans-Himalaya. The area covered under the PA Network for protection of wildlife in the Himalayas is 41,597 km² (Table 4). A total of 77 PAs in the Himalayas are believed to have pheasants. The area covered under the PAs network in Trans Himalaya is 14,506.km² (7 PAs) while the Himalayas has the highest coverage *i.e.*, 23,941 km². Of the 23,941 km² PAs in Himalayas, area of the Western Himalaya under PA network is 4,117 km². the Central Himalaya is 6,072.km². and the Eastern Himalaya is 13,750.km². Apart from this, a total of 11 PAs covering more than 1,350 km². area in the northeast India also protecting minimum of two species of pheasants.

Pheasants Species Richness in Protected Areas of Himalayas and surrounding areas.

Impeyan Monal, Kalij and Koklass seems to be the most common pheasants in the Himalaya as it is reported from 46, 43 and 36 PAs respectively. All these three pheasants excepting koklass occur in all the Himalayan Biogeographic Provinces except 2D. Distribution of Tibetan Eared Pheasant, Sclater's Monal, Green Peafowl, Grey Peacock Pheasant, Blyth's Tragopan and Temminck's Tragopan are either not covered under the present PAs network or detailed distribution of these species is not available.



Table 4 : Distribution of Pheasants in the Protected Areas of Himalayas and Northeast Biogeographic Zones. (+: presence, -: absence, ? = unknown)

Biogeographic Zone	Biogeographic Province	State	Protected Area	Year of Establishment	Area (km ²)	Altitudinal Range (m)	Cheer Pheasant	Tibetan Eared-Pheasant	Red Junglefowl	Blood Pheasant	Himalayan Monal	Sclater's Monal	Kailij Pheasant	Indian Peafowl	Green Peafowl	Grey Peacock-Pheasant	Koklass Pheasant	Mrs Hume's Pheasant	Blyth's Tragopan	Western Tragopan	Satyr Tragopan	Temminck's Tragopan	No. of species
2	2A	Jammu & Kashmir	Baltal-Thajwas WS	1987	210	NA	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	2
			Dachigam NP	1981	141	1642-4289	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	2
			Gulmarg WS	1987	180	2400-4300	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	2
			Hirapora WS	1987	114.5	2557-4745	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	2
			Kishtwar NP	1981	400	1700-4800	?	-	-	-	+	-	?	-	-	-	+	-	-	-	+	-	3
			Lachipora WS	1987	93.5	1630-3300	+	-	+	-	+	-	?	-	-	-	+	-	-	-	+	-	5
			Overa WS	1981	32	2100-5425	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	2
			Overa-Aru WS	1987	425	2250-6000	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	2
			Trikuta WS	1981	27.75	450-600	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	2
			City Forest NP	1992	9.07	NA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
			Limber WS	1987	43.75	NA	+	-	+	-	+	-	?	-	-	-	+	-	-	-	+	-	5
			Hokersar WS	1992	13.75	1584	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
		Himachal Pradesh	Bandli WS	1962	41.32	762-2160	+	-	?	-	-	-	+	-	-	-	-	-	-	-	-	-	2
			Gangul-Siahbehi WS	1962	108.85	1800-3919	?	-	-	-	+	-	+	-	-	-	+	-	-	+	-	-	4
			Great Himalayan NP	1984	754.4	1500-5805	+	-	-	-	+	-	+	-	-	-	+	-	-	+	-	-	5
			Kais WS	1954	14.19	2800-3680	?	-	?	-	+	-	-	-	-	-	+	-	-	+	-	-	3
			Kalatop-Khajjair WS	1958	61	1185-2768	-	-	-	-	+	-	+	-	-	-	+	-	-	+	-	-	4
			Kanwar WS	1954	54	1800-4833	+	-	-	-	+	-	+	-	-	-	+	-	-	+	-	-	5
			Khokhan WS	1954	14.05	1500-2787	?	-	-	-	-	-	+	-	-	-	+	-	-	+	-	-	3
			Kugti WS	1962	378.86	2250-6044	-	-	-	-	+	-	-	-	-	-	+	-	-	?	-	-	2



Biogeographic Zone	Biogeographic Province	State	Protected Area	Year of Establishment	Area (km ²)	Altitudinal Range (m)	Cheer Pheasant	Tibetan Eared-Pheasant	Red Junglefowl	Blood Pheasant	Himalayan Monal	Sclater's Monal	Kailj Pheasant	Indian Peafowl	Green Peafowl	Grey Peacock-Pheasant	Koklass Pheasant	Mrs Hume's Pheasant	Blyth's Tragopan	Western Tragopan	Satyr Tragopan	Temminck's Tragopan	No. of species
			Lippa Asrang WS	1962	30.89	4000-5022	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	1
			Manali WS	1954	31.8	2273-5300	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	2
			Nargu WS	1962	278.37	970-4034	?	-	-	-	+	-	+	-	-	-	+	-	-	?	-	-	3
			Rupi Bhaba WS	1982	269	909-5650	+	-	-	-	+	-	+	-	-	-	+	-	-	+	-	-	5
			Sechu Tuan Naia WS	1962	102.95	2550-6072	?	-	-	-	+	-	-	-	-	-	+	-	-	+	-	-	3
			Shikari Devi WS	1962	72	1800-3359	?	-	-	-	-	-	+	-	-	-	+	-	-	-	-	-	2
			Tundah WS	1962	64.22	2074-5532	?	-	-	-	+	-	+	-	-	-	+	-	-	-	+	-	4
			Tirthan WS	1992	61.12	2100-4875	+	-	-	-	+	-	+	+	+	-	+	+	-	-	+	-	6
			Sainj WS	1994	90	NA	+	-	-	-	+	-	+	-	-	-	+	+	-	-	+	-	5
			Chail WS	1976	108.54	701-2408	+	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	3
			Churdhar WS	1985	56.15	2000-3647	+	-	+	-	+	-	+	-	-	-	+	+	-	-	+	-	6
			Daranghati WS	1962	167	2100-3315	+	-	+	-	+	-	+	-	-	-	+	+	-	-	+	-	6
			Darlaghat WS	1962	140	1075-2069	+	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	3
			Majathal WS	1954	40	900-1966	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	2
			Sangla WS	1989	650	3200-5486	+	-	-	-	+	-	-	-	-	-	+	+	-	-	+	-	4
			Shilli WS	1963	2.13	1230-1845	+	-	+	-	-	-	+	-	-	-	-	-	-	-	-	-	3
			Shimla Water Catchment WS	1958	10.25	1900-2620	?	-	-	-	-	-	+	-	-	-	+	+	-	-	-	-	2
			Talra WS	1962	26	1500-3324	?	-	-	-	+	-	+	-	-	-	-	?	-	-	+	-	3
		Uttarakhand	Askot Musk Deer WS	1986	599.93	2400-5000	+	-	-	-	+	-	+	-	-	-	-	+	-	-	-	+	5



Biogeographic Zone	Biogeographic Province	State	Protected Area	Year of Establishment	Area (km ²)	Altitudinal Range (m)	Cheer Pheasant	Tibetan Eared-Pheasant	Red Junglefowl	Blood Pheasant	Himalayan Monal	Sclater's Monal	Kallij Pheasant	Indian Peafowl	Green Peafowl	Grey Peacock-Pheasant	Koklass Pheasant	Mrs Hume's Pheasant	Blyth's Tragopan	Western Tragopan	Satyr Tragopan	Temminck's Tragopan	No. of species
			Binsar WS	1988	45.59	2000-3000	+	-	-	-	+	-	+	-	-	-	+	-	-	-	-	-	4
			Gangotri NP	1989	1552	1800-7083	-	-	-	-	+	-	+	-	-	-	+	-	-	-	-	-	3
			Govind NP	1990	472.08	1400-6323	-	-	-	-	+	-	+	-	-	-	+	-	-	+	-	-	4
			Govind Pashu Vihar WS	1955	481	1400-6323	+	-	-	-	+	-	+	-	-	-	+	-	-	+	-	-	5
			Kedarnath WS	1972	957	1160-7068	+	-	-	-	+	-	+	-	-	-	+	-	-	-	-	-	4
			Nanda Devi NP	1982	624.62	3500-7816	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	2
			Valley of Flowers NP	1982	87.5	3267-6727	-	-	-	-	+	-	-	-	-	-	+	-	-	-	-	-	2
			Mussoorie WS	1993	10.82	?	+	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	2
	2C	Sikkim	Fambong Lho WS	1984	51.76	1375-2650	-	-	-	-	-	-	+	-	-	-	-	-	-	-	+	-	2
			Maenam WS	1987	35.34	1600-3250	-	-	-	-	+	-	+	-	-	-	?	-	-	-	+	-	3
			Khangchendzonga NP	1977	1784	1829-8585	-	-	-	+	+	-	+	-	-	-	-	-	-	-	+	-	4
			Kilam WLS	2005	6	NA	-	-	+	-	-	-	+	+	-	-	-	-	-	-	-	-	3
			Kyongnosia Alpine WS	1977	31	3292-4116	-	-	-	+	+	-	-	-	-	-	-	-	-	-	+	-	3
			Pangolakha WLS	2002	128	NA	-	?	-	+	+	-	+	-	-	-	-	-	-	-	+	-	4
			Barsey Rhododendron WS	1998	104	1600-3600	-	-	-	+	+	-	+	-	-	?	-	-	-	-	+	-	4
			Shingba Rhododendron WS	1984	43	3048-4575	-	-	-	+	+	-	-	-	-	-	-	-	-	-	?	-	2
	West Bengal		Jorepokhri WS	1985	0.04	?-1800	-	-	-	-	-	-	?	-	-	?	-	-	-	-	+	-	1
			Mahananda WLS	1976	158.04	725-1300	-	-	-	-	-	-	?	-	-	?	-	-	-	-	?	-	0
			Neora Valley NP	1986	88	3040-3200	-	-	-	-	+	-	?	-	-	?	-	-	-	-	-	?	1
			Senchal WS	1976	38.88	1500-2600	-	-	-	-	+	-	+	-	-	?	-	-	-	-	-	?	2
			Singalila WS	1986	78.6	2290-3650	-	-	-	-	+	-	-	-	-	?	-	-	-	-	-	?	1



Biogeographic Zone	Biogeographic Province	State	Protected Area	Year of Establishment	Area (km ²)	Altitudinal Range (m)	Cheer Pheasant	Tibetan Eared-Pheasant	Red Junglefowl	Blood Pheasant	Himalayan Monal	Sclater's Monal	Kailij Pheasant	Indian Peafowl	Green Peafowl	Grey Peacock-Pheasant	Koklass Pheasant	Mrs Hume's Pheasant	Blyth's Tragopan	Western Tragopan	Saltyr Tragopan	Temminck's Tragopan	No. of species
	2D	Arunachal Pradesh	D'Ering WS	1978	190	100-250	-	-	+	+	?	?	?	?	-	-	?	-	-	+	-	?	2
			Dibang WS	1991	4149	1500-5000	-	-	?	?	?	?	?	-	-	-	?	-	-	?	-	?	1
			Eagle Nest WS	1989	217	1100-2980	-	-	?	+	?	?	?	-	-	-	+	-	-	+	-	?	4
			Itanagar WS	1978	140.3	210-1164	-	-	+	+	?	?	?	-	-	-	+	-	-	?	-	?	3
			Kamlang WS	1989	783	NA	-	-	?	+	?	?	?	-	-	-	?	-	-	?	-	?	1
			Mehao WS	1980	281.5	330-3560	-	-	?	+	?	?	?	-	-	-	?	-	-	+	-	?	2
			Lado WS (proposed)	NA	500	2500-5000	-	-	?	+	?	?	?	-	-	-	?	-	-	?	-	?	1
			Mouling NP	1986	483	700-3060	-	-	?	+	?	?	?	-	-	-	?	-	-	+	-	?	2
			Namdapha NP	1983	1807.82	200-4500	-	-	+	+	?	?	?	-	-	-	+	-	+	+	-	?	5
			Pakke WS	1977	861.95	150-1900	-	-	+	+	?	?	?	-	-	-	+	-	-	?	-	?	4
			Palin WS (proposed)	NA	250	2000-2800	-	-	?	+	?	?	?	-	-	-	?	-	-	?	-	?	1
			Sessa Orchid WS	1989	100	800-3100	-	-	?	+	?	?	?	-	-	-	+	-	-	+	-	?	4
			Tale Valley WS	1995	337	1500-2700	-	-	?	+	?	?	?	-	-	-	?	-	-	?	-	?	1
			Kane WS	1991	55	NA	-	-	+	+	?	?	+	-	-	-	+	-	-	?	-	?	4
			Yardi-Rabe Supse WS		491.62	NA	-	-	?	+	?	?	?	-	-	-	?	-	-	?	-	?	1
			Tawang NP/WS (proposed)	NA	300	2000-5000	-	-	?	+	?	?	?	-	-	-	?	-	-	?	-	?	1
			Walong WS (proposed)		300	2000-5000	-	-	?	+	?	?	?	-	-	-	?	-	-	?	-	?	1



Biogeographic Zone	Biogeographic Province	State	Protected Area	Year of Establishment	Area (km ²)	Altitudinal Range (m)	Cheer Pheasant	Tibetan Eared-Pheasant	Red Junglefowl	Blood Pheasant	Himalayan Monal	Sclater's Monal	Kalij Pheasant	Indian Peafowl	Green Peafowl	Grey Peacock-Pheasant	Koklass Pheasant	Mrs Hume's Pheasant	Blyth's Tragopan	Western Tragopan	Satyr Tragopan	Terminck's Tragopan	No. of species
9	9A	Assam	Diding-Patkai WLS (proposed)	NA	NA	NA	-	-	+	-	-	-	-	-	-	?	-	-	?	-	-	-	1
	9B	Manipur	Yangoupokpi-Lokchao WS	1989	184.8	1000-2100	-	-	?	-	-	-	-	-	-	?	-	?	?	-	-	-	0
		Meghalaya	Balphakram NP	1985	220	192-1023	-	-	+	-	-	-	-	-	-	?	-	?	?	-	-	-	1
			Nokrek Ridge WS	1986	47.48	600-1412	-	-	+	-	-	-	-	-	-	?	-	?	?	-	-	-	1
		Mizoram	Dampa WS	1985	500	500-1090	-	-	+	-	-	-	-	-	-	?	-	?	?	-	-	-	1
			Murlen NP	1991	200	1000-1500	-	-	+	-	-	-	-	-	-	?	-	?	?	-	-	-	1
			Khawnglung WS	1992	41	400-1300	-	-	?	-	-	-	-	-	-	?	-	?	?	-	-	-	0
			Phawngpui WS	1992	50	NA	-	-	?	-	-	-	-	-	-	?	-	?	?	-	-	-	0
			Pualeng WLS	2004	50	NA	-	-	?	-	-	-	-	-	-	?	-	?	?	-	-	-	0
			Thorangtiang WLS	2002	50	NA	-	-	?	-	-	-	-	-	-	?	-	+	?	-	-	-	1
		Nagaland	Fakim WS	1980	6.41	2000-2729	-	-	?	-	-	-	-	-	-	?	-	?	?	-	-	-	0
						No. of PAs	21	0	24	21	46	0	43	7	0	6	36	2	6	20	10	0	



Recommendations

- i. It is important to protect the certain habitats of Tibetan Eared Pheasant, Sclater's Monal, Green Peafowl, Grey Peacock Pheasant, Blyth's Tragopan and Temminck's Tragopan by declaring some of their range as PAs or Conservation/Community Reserves or Biodiversity Heritage Sites. In this connection, a survey on these species aimed to identify their population status, distribution pattern and habitat quality need to be taken immediately
- ii. The biogeographical analysis yields five major Galliformes assemblages within India. Of these, four are from the Himalayan regions. Therefore, it would be better to focus on the Galliformes for conservation of the entire Himalayan ecosystem that is because of the ubiquitous distribution of Galliformes in the Himalayas.
- iii. Among the Himalayas, Western Himalaya, which is home to several endangered species including the Western Tragopan is not adequately covered under the PAs Network compared to other two biogeographic provinces of Himalayas. Hence, it is proposed to identify certain important pheasant habitats in the Western Himalaya and declare the same as either Conservation/Community Reserve or Biodiversity Heritage Sites or PAs.
- iv. Some of the Galliformes species are known to occur around human habitations (outside PAs) and also believed that there is an interface between Galliformes and human with respect to agriculture. It is necessary to assess their status in and outside of

the PAs as well as in human habitations and also to study their impact on agro-ecosystem *vis-versa*.

- iv. Seven Galliformes species that are endemic to India deserve more conservation attention. Though, certain populations of these species protected in at least one PA, more protection is required especially for Himalayan Quail, Megapode, Grey Junglefowl, Red spurfowl and Painted spurfowl.
- vi. Grey Junglefowl, endemic to India especially to southern part of India is believed to be declining especially those populations, that occur outside the PAs. It is important to know their present population status and include some of their distribution range in the PA Network of India.

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9.0 Conservation of Galliformes in the Indian Himalaya

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Introduction

Galliformes, commonly called 'game birds' are represented by over 280 species worldwide, and comprise pheasants, partridge, quail, francolins, grouse, cracids and megapodes. In India, galliformes are represented by 45 species, the notable omissions being the Meleagridinae (turkeys), Tetraoninae (grouse), Cracinae (cracids and curassows) and Penelopinae (guans). Of the 44 species, 17 are Pheasants, 27 are Partridges, Quails and Francolins (PQF), and one is a Megapode. The species are spread across the country and apart from wetlands, are found in all habitats. The threats too, are wide spread and as a result, and have reportedly caused a steady decline in their numbers. In India, six species of Pheasant, four PQF, and the sole megapode species are globally threatened with extinction. Most galliformes in India are afforded legal protection by the Wildlife (Protection) Act, 1972..

The Himalayan region of India is rich in pheasants accounting for over 80 % of all species found in India. This is in contrast to the PQF in the Himalaya with just over 40% of all PQF found in India being found here. Although the distribution ranges of pheasants have not shown much decline, their contiguity has been lost due to fragmentation. Some small sub-populations might actually have been extirpated due to the combined influence of habitat loss and hunting.

This paper examines the present status and distribution of galliformes in the Himalaya and assesses their conservation status.

Distribution

Seventeen species of pheasants occur in India and of these, 14 are restricted to the Himalaya. In addition, two species - the Blue Peafowl (*Pavo cristatus*) and the Red Junglefowl (*Gallus gallus*) are also found in the central and peninsular India. In terms of pheasants, the eastern Himalaya is richer with 11 species compared to eight in the western Himalaya. The eastern Himalaya also has more species (seven) exclusive to it whereas; four species viz., Satyr Tragopan (*Tragopan satyra*), Himalayan Monal (*Lophophorus impejanus*), Kalij (*Lophura leucomelanos*), and Red Junglefowl (*Gallus gallus*) are common across

the two regions. Only three species of pheasants (Western Tragopan *Tragopan melanocephalus*, Cheer *Catreus wallichii*, and Koklass *Pucrasia macrolopha*) are exclusive to Western Himalaya.

Of the six species of pheasants that are threatened in India, five are found in the Himalaya. Cheer pheasant and Western Tragopan in the Western Himalaya and Sclater's Monal, Hume's Pheasant (*Symaticus humiae*) and Blyth's Tragopan (*Tragopan blythii*) in the eastern Himalaya. More details about the status and distribution can be found in the species accounts chapter of this edition (Also see Table 1).

Of the 27 PQF found in India, 11 (40%) are found in the Himalaya and the rest in the lowlands. Only one species, the Common Quail ranges across both the altitudes as it is a migrant. The Black Francolin (*Francolinus francolinus*) although predominant in the central India, also ranges in the fringe areas of some portions of the Himalaya. There is also little overlap across the western and eastern Himalayan species with only the Hill partridge and the Rufous-throated Partridge running across the Himalaya. In terms of PQF species, five are exclusive to the western Himalaya, while four are common across the entire Himalaya. Only two species are exclusive to the Eastern Himalaya.

Therefore, Himalayan galliformes show regional endemism. In the western Himalaya, most galliformes occur in the 2,500-3,000m altitude zone including threatened species such as the Cheer and Western Tragopan along with the commoner ones. Even in other regions, the 2,500-3,000 m altitude belt appears to be rich in galliformes (Table 2).

Conservation Issues

Despite over two decades of work on galliformes by several people in India, we still do not have population estimates available for most pheasants. Thus we are not able to examine impacts of various threats on galliformes in India. Fuller and Garson (2000) and Fuller *et al.* (2000) have listed several factors that may affect galliformes numbers. These are:



Table 1 : Status of Galliformes in the Himalaya

S. No	Name	Scientific name	Status IUCN
1	Sclaters Monal	<i>Lophophorus sclateri</i>	V
2	Himalayan Monal	<i>Lophophorus impejanus</i>	Lc
3	Western Tragopan	<i>Tragopan melanocephalus</i>	V
4	Temminck's Tragopan	<i>Tragopan temminckii</i>	Nt
5.	Satyr Tragopan	<i>Tragopan satyra</i>	Lc
6.	Blyth's Tragopan	<i>Tragopan blythii</i>	V
7.	Koklass Pheasant	<i>Pucrasia macrolopha</i>	Lc
8.	Cheer Pheasant	<i>Catreus wallichii</i>	V
9.	Kalij Pheasant	<i>Lophura leucomelanos</i>	Lc
10	Blood Pheasant	<i>Ithaginis cruentus</i>	Lc
11.	Hume's Pheasant	<i>Symaticus humiae</i>	V
12.	Red Junglefowl	<i>Gallus gallus</i>	Lc
13.	Tibetan Eared Pheasant	<i>Crossoptilon crossoptilon</i>	Nt
14	Tibetan Snowcock	<i>Tetraogallus thibetanus</i>	Lc
15.	Himalayan Snowcock	<i>Tetraogallus himalayensis</i>	Lc
16.	Buff-throated Partridge	<i>Tetraophasis szechenyii</i>	Nt
17.	Common Quail	<i>Coturnix coturnix</i>	Lc
18	Himalayan Quail	<i>Ophrysia superciliosa</i>	CE
19	Chestnut-breasted Partridge	<i>Arborophila mandellii</i>	V
20	Rufous-throated Partridge	<i>Arborophila rufogularis</i>	Lc
21.	Hill Partridge	<i>Arborophila torqueola</i>	Lc
22.	Snow Partridge	<i>Lerwa lerwa</i>	Lc
23.	Tibetan Partridge	<i>Perdix hodgsoniae</i>	Lc
24.	Chukar	<i>Alectoris chukar</i>	Lc

V= Vulnerable, Lc=least concern, Nt= near threatened, CE=Critically Endangered

Habitat loss

It does appear that actual loss of habitat (changes in land use) has declined to a great extent in the last few years in India and may not now be a cause for too much worry regarding galliformes survival in India. However, people still depend on forest resources for their sustenance and livelihood (Hilaluddin *et al.* 2005) and as a result the quality of habitats has been degraded. This has possibly affected galliformes numbers in some areas, especially Tragopans. Koklass appear to be more resilient to habitat degradation and may live in sub-optimal habitats albeit in lower abundance. Species thriving in secondary/open habitats such as cheer may benefit from habitat degradation through sustained interference (shifting cultivation, browsing, clearing etc.) as reported by Kaul (1989) and Garson *et al.* (1992).

Hunting

Galliformes, by virtue of their closeness to chicken have always been used for their meat. The introduction of the Wildlife (Protection) Act in India put an end to the legal hunting of galliformes, yet they continue to be hunted, both for subsistence and sale all across the country. Though trade in live birds is not large in quantity, trade in feathers (Grey Junglefowl *Gallus sonneratii* hackles and peafowl feathers) has been reported frequently. Although it is difficult to judge the impact of such extractions on wild populations, it is apparent that species that are threatened will face more severe impacts. Threatened species such as Ttragopans (Western and Blyth's) are sold in markets or covertly, other threatened species such as Cheer are consumed locally.



Human Disturbances

Humans enter forest for a variety of reasons ranging from collection of timber to NTFP and their presence is regarded as a factor causing disturbance to galliformes at critical times. The collection of *gucchi* or morrel mushroom (*Morchella*) in the western Himalaya coincides with the breeding season of Western Tragopan and often may cause hens to abandon nests or result in eggs being stolen by them. The people are also accompanied by dogs which also become potential source of disturbance. Similarly medicinal plants collectors, *ringal* or montane bamboo collectors, all are potential sources of disturbance. Although such threats have been reported (Ramesh *et al.* 1999), the impacts of these disturbances have however not been quantified in India to suggest how important they are. In China, Brown-eared Pheasant (*Crossoptilon Mantchuricum*) nesting has been reportedly disturbed by morrel collectors (Zhang Zheng-wang 1998).

Hybridization

The only galliformes threatened by hybridization with domestic stock in India is the Red Junglefowl. Investigations are on to see the extent of hybridization in the wild populations (Sathyakumar *et al.* 2002). A study based on physical examination of specimens held in Indian zoos showed that the majority examined showed physical attributes characterized by pure forms (Kaul *et al.* 2002).

Pesticides

The intensification of the agriculture in India has ushered in an era of increased use of organo-chlorides and organo-phosphates. Farmland birds such as the Indian peafowl, the grey francolin (*Francolinus pondicerianus*), the painted francolin (*Francolinus pictus*) and some quail species are probably affected adversely. Although peafowl mortalities have been attributed to pesticides, it has not been demonstrated empirically yet. Such studies are underway. Similar reports of species declines have also been reported from Europe especially in the United Kingdom where severe declines in the grey francolin were reported (Potts 1986). In the Himalaya however, use of pesticides is still not that prevalent and the Himalayan galliformes are relatively secure from this threat.

Relevance of Protected Areas

How important are Protected Areas (PA) for conservation of galliformes especially in India? An analysis seeking answers to this question has been conducted by McGowan *et al.* (1999). The analysis came up with a list of PAs considered vital for the survival of this species.

The threatened species of galliformes in India are threatened mainly on account of their restricted range. Species such as

the Western Tragopan, that appear to be habitat specialists are thus confined to only a few patches of habitat in the western Himalaya. PAs would therefore play a greater role in conservation of such species for these would afford better protection against habitat changes and poaching. It may however be pertinent to add here that in Chamba region of Himachal Pradesh which arguably has the highest population of this species in India, all sites with Western Tragopan are outside the PA network (Jandrotia *et al.* 2000). Despite the hunting pressures, the Western Tragopan is surviving. The same can not be said about the Tragopans of northeast India for *jhumming* (shifting cultivation) is still prevalent there which causes considerable alterations in habitats and thus impacts the Tragopans directly.

On the other hand, species such as the Cheer is found, both within the PA network and outside. Cheer is also a habitat specialist thriving in subtropical or lower temperate grasslands/scrublands. Such habitats are small patchily distributed in the western Himalaya and thus are bound to occur outside the PA network. Thus Cheer thrives in such habitats as well and more Cheer sites outside the PA network are being discovered, (Ex. Pilang in Uttarakhand state). Rest of the species occur right across their historical ranges and in varying abundance, depending on the nature of protection afforded at each site.

Conservation initiatives

The main responsibility of wildlife conservation lies with the state governments with support of the central Ministry of Environment and Forests, the support being mainly in the form of financial allocations. The central ministry also issues guidelines which provide broad directions to the states in matters pertaining to wildlife conservation. The centre has also been proactive in promoting conservation of certain species – considered flagships of conservation of the areas of their distribution. The tiger (*Panthera tigris*) for instance is one species which has received considerable attention of the government, demonstrated by the establishment of the Project Tiger and the Tiger Reserves across the country and now the National Tiger Conservation Authority, an autonomous body with more teeth. The Asian Elephants (*Elephas maximus*) too have benefited from the Project Elephant dedicated for its conservation. The recent one added to the list has been the Project Snow Leopard, using the Snow Leopard (*Uncia uncia*) as a flag ship for the trans-Himalayan fauna. In this whole scheme of using flagships for conservation, the Himalayas seem to have slipped from the policy makers attention. The responsibility of conservation of galliformes thus wrests solely on the state governments.

The Central Zoo Authority on its part has taken initiatives – to undertake conservation breeding of threatened species



in some select zoos/pheasantries. Some states have benefited from this but most states have lacked the initiative of taking advantage of this scheme.

Much of the plans of different State Forest and Wildlife Departments have been discussed in this volume under state accounts, I would like to summarize my assessment here.

Jammu and Kashmir

Has two threatened species, the Cheer and the Western Tragopan. Pheasants were never on the main agenda, being over shadowed by the declining Kashmir Stag or *Hangul* (*Cervus elaphus hanglu*) although occasionally, some attempts to breed them in captivity did occur. With the proposed upgradation of Limber Wildlife Sanctuary (WS) to a National Park (NP), it is expected that these two species will receive better degree of protection. There are no studies to indicate that pheasant numbers have gone down, on the contrary unconfirmed reports suggest that during following the years of strife in the valley, the numbers have actually gone up. The Western Tragopan population certainly seems to be healthy in Limber but more surveys need to be taken up in the Kishtawar-Baderwah area and also along the Pir Panjal range to ascertain the distribution of this pheasant. Although hunting occurs locally, I do not think it is a major problem in the state to affect galliformes to that extent.

Himachal Pradesh

This is perhaps the only state which has recognized these birds as flagships of their forests and has shown intent to actively conserve them. Their initiatives have been occasional census exercises for and an ambitious conservation breeding project on Western Tragopan and Cheer. Though chicks have now been produced in *ex-situ* conditions, the main phase – re-introduction is a long way away. A simultaneous project to identify sites for such re-introductions must get underway quickly so that sites are made ready for release. Himachal Pradesh has taken the initiative and will need to be supported technically so that their endeavours bear fruit. Earlier, a study on the ecology of pheasants in the Great Himalayan NP was also financially assisted by the State Forest Department.

Hunting remains a problem in Himachal and galliformes too suffer as a result. Enforcement in remote areas is non-existent and perhaps not expected so local village committees should be made responsible for ensuring that illegal hunting is reduced.

Uttarakhand

The critically endangered Himalayan quail (*Ophrysia superciliosa*) was last sighted in Banog near Mussourie

which has now been declared into a Himalayan Quail Sanctuary, *i.e.*, Banog WS. Intensive surveys are required to confirm the presence of Himalayan Quail in this PA (Also see chapter 7.0 in this issue). The rich galliformes fauna of the state has been well protected through the network of PAs in the state, notably the Nanda Devi Biosphere Reserve and Kedarnath WS. Some captive breeding attempts for Galliformes in the Nainital Zoo have been undertaken.

A fairly comprehensive mapping exercise has been undertaken recently (Ramesh *et al.* 2008) to identify 'galliformes hotspots' within the state and also to see the relevance of the PA system for conservation of galliformes within the state. Hopefully, the state will take some of the recommendations expected to come out of the study on board and take initiatives to conserve these birds.

Hunting is quite prevalent in Uttarakhand and does take good toll of galliformes. Steps need to be taken to see that loss due to hunting is reduced and using local grassroots institutions could play a role (Virdi, 2008).

Sikkim

There have been no specific initiatives taken by Sikkim government to conserve galliformes in the state. Efforts have mostly remained confined to development of PAs within the state and some efforts to establish captive breeding populations of some species..

The state does not possess any species of major conservation concern but areas for each species need to be identified which can be monitored periodically. As in other parts of the Himalaya, hunting is prevalent and its prevention requires better enforcement. Some local level groups in the form of *Himal Rakshaks* have been formed which can be used in lowering hunting.

West Bengal (North Bengal)

Most of the initiatives in the state of west Bengal have been confined to largely captive breeding although in around 1995, the West Bengal Forest Department funded a study on the Satyr Tragopan in Singhalila National Park, which also has the threatened Chestnut-breasted Partridge (*Arborophilla mandellii*).

Arunachal Pradesh

This state is the richest in terms of galliformes which include three species of threatened pheasants and two of Partridge/ Francolin. The government initiatives have not been many however, apart from affording protection to animals, largely within the PA network. Given the hunting pressures on wild animals in this state, it is imperative that the government comes out with a clear plan to secure the future of pheasants of this area.



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Table 2 : Distribution of Galliformes in the Indian Himalayas

Elevation (m)	Western	West-Central	Central-eastern	Eastern
4,000	Himalayan Snowcock, Tibetan Snowcock, Chukar, Tibetan Partridge	Himalayan Snowcock, Tibetan Snowcock, Chukar	Tibetan Snowcock	Sclaters Monal, Himalayan Monal, Buff- throated Partridge,
3,500	Himalayan Snowcock, Chukar, Himalayan Monal, Western Tragopan, Koklass	Himalayan Monal, Satyr Tragopan, Koklass, Blood Pheasant, Snow partridge, Tibetan Snowcock, Chukar,	Himalayan Monal, Blood pheasant	Himalayan Monal, Tibetan Eared pheasant, Sclater's Monal
3,000	Chukar, Western Tragopan, Koklass, Himalayan Monal, Kalij,	Satyr Tragopan, Himalayan Monal, Chukar, Kalij, Koklass, Cheer, Hill Partridge	Blood Pheasant, Himalayan Monal, Satyr tragopan	Temmincks Tragopan, Himalayan Monal, Blood Pheasant,
2,500	Koklass, Cheer, Himalayan Monal, Kalij, Chukar, Red Junglefowl, Hill Partridge, Western Tragopan	Himalayan Monal, Chukar, Hill Partridge, Rufous-throated Partridge, Himalayan Quail, Common Quail, Satyr Tragopan	Himalayan Monal, Satyr Tragopan, Hill Partridge, Chestnut -breasted Partridge, Hill Partridge	Temmincks Tragopan, Himalayan Monal, Blyth's Tragopan, Red -breasted Partridge, Hill Partridge
2,000	Red Junglefowl, Kalij, Cheer, Koklass. Hill Partridge	Red Junglefowl, Kalij, Cheer, Koklas, Hill Partridge, Rufous-throated Partridge	Hill Partridge, Chestnut-breasted Partridge, Kalij, Rufous-throated Partridge	Blyth's Tragopan, Hill Partridge, Red-breasted Partridge, Kalij, Grey Peacock Pheasant, Rufous-throated Partridge
1,500	Red Junglefowl, Blue Peafowl, Kalij, Black Francolin	Red Junglefowl, Kalij, Black Francolin, Cheer, Koklass, Himalayan Quail	Kalij, Red Junglefowl, Black Francolin	Kalij, Red Junglefowl, Grey Peacock Pheasant, Red-breasted Partridge, Hume's Pheasant, Blyth's Tragopan, Black Francolin
1,000	Red Junglefowl, Kalij, Blue Peafowl, Black Francolin	Red Junglefowl, Kalij, Blue Peafowl, Black Francolin	Kalij, Red Junglefowl, Black Francolin	White-cheeked Hill partridge, Red Junglefowl, Grey Peacock Pheasant, Kalij, Black Francolin
500	Red Junglefowl, Blue Peafowl, Black Francolin	Red Junglefowl, Kalij, Blue Peafowl, Black Francolin	Kalij, Red Junglefowl, Grey Peacock Pheasant, Manipur Bush Quail, Black Francolin	Kalij, Red Junglefowl, Grey Peacock Pheasant, White-cheeked Partridge, Black Francolin



10.0 Status, Distribution and Management of Galliformes in Arid and Semi-arid Zones of India

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Introduction

The agro-ecological regions in India fall into six major climatic regions viz. arid, semi-arid, dry sub-humid, moist sub-humid, humid and per-humid (Velayutham, 1999). The hot arid zone occupies major parts of Rajasthan, Gujarat, southern parts of Punjab and Haryana and a small portion of Deccan Peninsula in the states of Andhra Pradesh, Karnataka and Maharashtra while cold arid regions are located in the Trans-Himalayan regions of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh. The semi-arid zone is spread over ten states in the country.

The Arid Zone

The arid zone of India covers about 15.8% of the geographical area including 31,900 million km² of hot desert located in parts of Rajasthan (61%), Gujarat (20%), Punjab and Haryana (9%), and Andhra Pradesh and Karnataka (10%). The arid regions of India cover over 300,000 km² and are spread over six states, mostly in the northwestern parts of the country. The Great Indian Desert or Thar Desert lies in western Rajasthan and comprising an area of 196,150 km². In addition, an area of 78,300 km²

of cold desert is located in the state of Jammu and Kashmir (Table 1, Fig. 1).

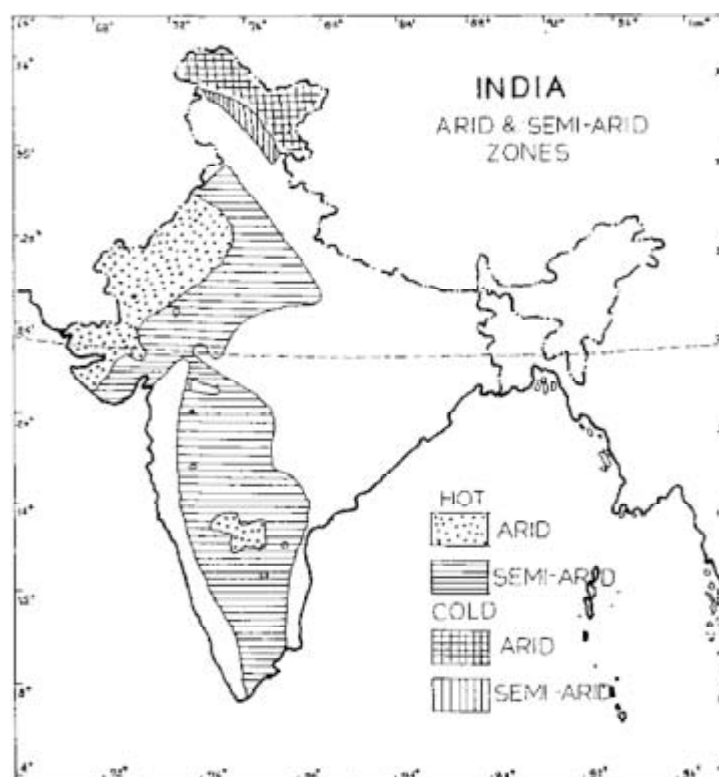
The climate in the arid regions has erratic rainfall, frequent droughts, high evaporation, intense heat and high velocity winds. The human population in the Indian arid zone is high, a part of which is nomadic maintaining a considerable livestock population. The density of both human and livestock population is moderately higher as compared to the national average, which has put the scarce natural resources of this zone under severe stress. There are a number of tribes such as the *Gujjars*, *Rathis*, *Banjaras*, *Raikars* and *Rabaris* which are nomadic and follow a pastoral system of living. The nomadic lifestyle has over the years been replaced by agrarian system in regions not suitable for arable cropping system, which has further degraded the fragile ecosystem. In arid zone, the growing season being very short, millets and short duration pulses dominate the cropping systems. Livestock farming forms an integral part of this ecosystem. There are six National Parks and Wildlife Sanctuaries in the deserts covering 16,076 km² or 7.45% of the bio-geographical area of the country.

Table 1 : Area under arid and semi-arid zones in India.

State	Arid Zone	Semi-arid Zone	Arid Zone	Semi-arid Zone
	Km²	Km²	Percentage	
Hot				
Rajasthan	1,96,150	1,21,020	61.0	13.0
Gujarat	62,180	90,520	19.6	9.0
Punjab & Haryana	27,350	58,650	9.0	6.0
Maharashtra	1,290	1,89,580	0.4	19.0
Karnataka	8,570	1,39,360	3.0	15.0
Andhra Pradesh	21,550	1,38,670	7.0	15.0
Tamil Nadu	-	95,250	-	10.0
Uttar Pradesh	-	64,230	-	7.0
Madhya Pradesh	-	59,470	-	6.0



Source: http://cee45q.stanford.edu/2003/briefing_book/images/india_climate_map.jpg



Source: <http://www.unu.edu/unupress/unupbooks/uu17ee/uu17ee0y.gif>

Fig. 1. Maps showing arid and semi-arid zones in India



The Semi-arid Zone

The semi-arid zone is a transition zone between desert and dense forests of Western Ghats. The semi-arid zone comprises 970,530 km², which is 37% of the total geographical area of the country. The semi-arid zone is distributed in the states of Punjab, Haryana, Rajasthan, Uttar Pradesh, Madhya Pradesh, Gujarat, Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu (Table 1, Fig. 1). In the semi-arid zones, the crops and cropping systems are quite diverse depending upon soil types and length of growing season. Sorghum, soyabean, groundnut and pulses are the major crops grown in this zone. The dominant grass and palatable shrub layer in this zone supports a high wildlife biomass. In the semi-arid zone, there are 91 National Parks and Wildlife Sanctuaries covering 15,302 km² or 2.8% of the bio-geographical area of the country.

Status and distribution of Galliformes species

In the arid and semi-arid zones of India, 19 galliformes species are reported to be present (Ali & Ripley 1987, Grimmett *et al.* 1998, Tables 2 & 3).

There are 11 species belonging to the partridge, quail and francolin (PQF) category and three pheasant species. The PQF species are Painted Francolin (*Francolinus pictus*), Grey Francolin (*Francolinus pondicerianus*), Black Francolin (*Francolinus francolinus*), Blue-breasted Quail (*Coturnix chinensis*), Rain Quail (*Coturnix coromandelica*), Common Quail (*Coturnix coturnix*), Rock Bush Quail (*Perdica argoondah*), Jungle Bush Quail (*Perdica*

asiatica), Painted Bush Quail (*Perdica erythrorhyncha*), Painted Spurfowl (*Galloperdix lunulata*), and Red Spurfowl (*Galloperdix spadicea*). The three pheasant species found in arid and semi-arid zones are Red Junglefowl (*Gallus gallus*), Grey Junglefowl (*Gallus sonneratti*) and Indian Peafowl (*Pavo cristatus*).

Rain Quail (*Coturnix coromandelica*) is the only species found in all the states throughout the arid and semi-arid zones in India (Table 3). Grey Francolin and Indian Peafowl are distributed uniformly throughout the hot regions of the arid and semi-arid zones in the country while Black Francolin remains restricted to northern, western and central regions. Painted Bush Quail and Painted Spurfowl are distributed in the central, western and southern parts of the arid and semi-arid zones.

Threats to galliformes in the arid and semi-arid zones in India

Although the arid and semi-arid zones in India have a better Protected Area network, there is immense pressure from human population growth and economic development, and these habitats face a huge challenge to balance human needs with the protection and management of natural habitats. The main causes of threats are expansion and intensification of agriculture, infrastructure development and excessive livestock grazing. Clearance, conversion and degradation of habitats are by far the most important causes of threats to galliformes species in these regions. Poaching is the second most common category of threat. These species are poached for food and sport and captured for the wild bird trade. Levels of exploitation of some species are clearly too high to be sustained. Habitat destruction has led

Table 2. : Number and distribution of Galliformes species in the states comprising of arid and semi-arid zones in India.

State	Number of Species		
	Pheasants	Partridge, Quail and Francolin	Total
Rajasthan	2	10	12
Gujarat	3	8	11
Punjab	1	5	6
Haryana	1	5	6
Maharashtra	3	10	13
Karnataka	2	10	12
Andhra Pradesh	3	9	12
Tamil Nadu	2	7	9
Uttar Pradesh	2	9	11
Kerala	2	9	11
Madhya Pradesh	3	11	14

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11.0 Review of Research on Pheasants in Southern India

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Introduction

Southern India is endowed with a rich diversity of galliformes, however, not much information is available with the exception of some surveys and short-term studies on the distribution, status, habitat requirements, diet, and activity pattern of a few galliformes species in southern India. A review of literature clearly indicates that there is a need for more research based information on the current status, distribution and habitat requirements of galliformes in southern India. It is needless to emphasize that such information will help in the long-term conservation and management of galliformes in southern India. This paper provides a review of research on two pheasants, viz., the Grey Junglefowl (*Gallus sonneratii*) and the Indian Peafowl (*Pavo cristatus*) in Southern India.

Grey Junglefowl

The endemic Grey Junglefowl is confined to Peninsular India. Kaul and Garson (1993) reported that existing information on the conservation status of Grey Junglefowl is insufficient for an assessment of its conservation status in India. Bird surveys in Kerala indicated that the status of Grey Junglefowl was lower than expected (Zacharias 1993, 1997). The occurrence of a small population of Grey Junglefowl in the northern Kerala near the Cannanore coast indicates that in the past the species had been widespread in Kerala from the coast to the high hills (Zacharias 1993). Random observations over the last 15 years in different parts of the Western Ghats show that the Grey Junglefowl, along with Peafowl, Red Spurfowl, Francolins and Quail, in this part of India has been declining fast, due to poaching and habitat degradation.

Investigations on the abundance, group sizes and sex ratios of Grey Junglefowl revealed variation between areas and habitats (Ramesh, 1994; Ravichandran, 1995 and Jammal, 1998; Kambarajan *et al.*, 2002; Sathyakumar, 2006, Sathyanarayana, 2007). On Mundanthurai Plateau, the Grey Junglefowl density estimates ranged from 1.67 to 34.42 groups/km² (group size range 1.0 to 1.6) with a mean density of 19.78 groups/km² (mean group size 1.3) and the male:female ratio of 1:1.2 (Sathyakumar, 2006), and in Theni

Forests, Tamil Nadu, it was estimated as 37.03 ± 2.81 birds/km² (Sathyanarayana, 2007).

Ecological information on Grey Junglefowl is limited to some habitat use studies. These include investigations by Tata and Gautam (1993) at Bori Wildlife Sanctuary, Madhya Pradesh; Subramanian *et al.* (2002); Ramesh and Sathyanarayana (2002) in Theni, Tamil Nadu, and Sathyakumar (2006) at Mundathurai Plateau, Tamil Nadu.

Subramanian *et al.* (2002) reported significant higher use of Southern Moist Mixed Deciduous Forest and Southern Dry Mixed Deciduous Forest in Summer and Pre-monsoon respectively by Grey Junglefowl at Theni, Tamil Nadu. Ramesh and Sathyanarayana (2002) reported that seven tree species (8-20m height) were preferred for roosting by the Grey Junglefowl at the Grizzled Giant Squirrel Sanctuary, Tamil Nadu. A study from Anaikatty Hills, Tamil Nadu, observed that the Grey Junglefowl used the mixed dry deciduous forest than the scrub forest (Nirmala and Vijayan, 2002). Sathyakumar (2006) reported that Grey Junglefowl used Dry deciduous forests particularly areas that had low to moderate canopy, moderate to high scrub cover interspersed with areas of low or no grass cover at Mundathurai Plateau, Tamil Nadu. Sathyanarayana (2007) has reported that the nest density of the Grey Junglefowl did not differ significantly between habitats at Theni, Tamil Nadu.

Grey Junglefowl is an omnivorous species and food items such as claw, mandible, ovipositor (grasshopper), head and other body parts (beetle, black ant, red ant), exoskeleton (millipede), egg shells, undigested remains of seeds such as *Capsicum* sp, *Cynodon* sp, *Ziziphus oenopli* and *Lantana camara* were isolated from its fecal matter collected from Theni, Tamil Nadu (Sathyanarayana and Ramesh, 2005).

Interestingly, it has been reported that the malarial parasite "*Plasmodium gallinaceum*" has been found in Grey Junglefowl in Madras market in 1939. Robin (1990) has highlighted the usefulness of Sonnerats in Leukaemia and AIDS research.



Indian Peafowl

The Indian Peafowl is a common and wide spread species that is revered in southern India for religious reasons. However, information on the current distribution and population status is not available.

Sathyanarayana and Rajadurai (1989) investigated the roost tree preference and distribution of Indian Peafowl at Viralmalai, Tamil Nadu, and found that the population in 20 villages was around 4,255 consisting of 1,468 males, 1,677 females, 435 subadults and 675 chicks. Sathyanarayana and Ramesh (1994) reported a population of 597 at the District Livestock farm, Machuvadi, Pudukottai, Tamilnadu. These studies revealed that the most of the Peafowl preferred *Albizia lebbek* for roosting. Sathyanarayana and Asokan (1996) counted a total of 1017 birds in 25 villages of Viralmalai Panchayat Union, Tamil Nadu. They also studied on the distribution, roosting tree preferences of Peafowls in 25 villages.

Johnsingh and Murali (1978) have studied the ecology and behaviour of Blue Peafowl at Injar, Tamilnadu. Navaneethakannan (1981) has reported the activity patterns in a colony of Peafowl in Tamilnadu.

Rajaraman *et al.* (1998) have carried out a preliminary work on the food preferences of the Indian Peafowl at Suriyur, Mathur, Vemmani and Neerpalani villages that fall under the Viralmalai Panchayat Union, Tamil Nadu. The diet analyses revealed that the plant matter constituted the bulk of the diet of Indian Peafowl and the animal matter was found only in low proportions. Among the plant matter, paddy formed the major proportion. Saravanan *et al.* (1997) have also reported that paddy comprised the bulk of diet.

Sathyanarayana and Veeramani (1993a,b) investigated the activity patterns, food habits and use of roost trees by the Indian Peafowl in Scrub jungle and Dry deciduous Forests of Mudumalai Wildlife Sanctuary, Tamilnadu. They found that the Peafowl roosted in eight tree species which includes species such as *Acacia sundra*, *Cordia obliqua*, *Bombax malabaricum*, *Zizphus jujuba*.

Sundaramurthy *et al.* (2002) carried out a study on the ecology and behaviour of the Indian Peafowl at Vembakkotai, Virudhunagar District, Tamil Nadu, from September 1995 to March 1996. They reported the sex ratio of adult male and female to be 1:0.72. Harem formation, display, roosting, preening, standing, vocalization, feeding and breeding were the major behavioural activities of Peafowl during the study period.

Solaiappan *et al.* (2002) have reported the sex ratio of adult male and female to be 1:0.76 based on their studies

on the population and behaviour of Indian Peafowl at Ketchilapuram Village, Tuticorin District, Tamil Nadu from July 1998 and January 1999. They also reported seasonal variation in group composition and grouping patterns of Indian Peafowl in three different seasons. Habitat destruction, poaching for meat and egg were the real threats to the Peafowl in this area. Despite the crop damage caused by Peafowl, the villagers of Ketchilapuram tolerate the presence of the Peafowl due to their religious sentiment.

Sathyanarayana and Senthilmurugan (2002) have done assessment studies on crop damage by Indian Peafowl in Tamilnadu. They have reported that the Peafowl primarily fed upon paddy and on finger millet (ragi) and estimated the percent crop damage as 34.2% with a crop loss of 142 g/ha/day. Overall results revealed that the bulk diet (88.9%) of the Peafowl constituted plant matter and that the animal matter constituted only 4.8% and grit 6.3%. It is very interesting to note that although there are many species of insects, only large black ants (*Camponotus sp*) were recovered from the faecal samples. The direct observations on the intact and damaged tillers showed that 1.9% paddy tillers /m² /day were damaged by the Peafowl. The results obtained from the direct assessment show that the Peafowl consumed 0.99 gms/m² area/day. The indirect crop damage evaluation from the faecal analysis shows that on an average the Peafowl consumed 3.29 g of paddy seeds [Mean weight of the seeds / faecal sample].

Sathyanarayana (2004) has done studies on bird pest management with special reference to Indian Peafowl in Tamilnadu. In order to protect their crops, the farmers in the villages of Viralmalai Panchayat Union, Pudukottai district, Tamilnadu, used audio tapes, scare dogs, and crackers to scare the Peafowl, although these methods were not very effective and economical. The use of reflective ribbon, a polypropylene metallic shining with red one side and silver white on other side was found to be very effective in preventing the peafowl from raiding crops from the paddy fields and other food crops.

Sathyanarayana (2002) has carried out investigations on the helminth infection in the Indian Peafowl and has reported occurrence of only *Ascaridia* sp. Manimozhi *et al.* (2002) have reported their observations on the courtship behaviour, egg laying, incubation, rearing and management of captive Indian Peafowl at Arignar Anna Zoological Park, Chennai.

Gayathri (2006) has studied the different types of Indian Peafowl feathers (oscillated, half moon, sword, wing and tail) to determine the number and size of each part of the feather. Parameters such as length of feather, number and average length of barbs, and length of barbs in and below



eye pattern have been estimated. Raja Priya (2007) investigated whether the peafowl are killed for feathers or only shed feathers are collected by the villagers in different villages in Viralimalai Panchayat Union, Pudukottai district for economic benefits.

Other species:

Priscilla and Jasmine (2002) have reported the importance of growing *Prosopis chilensis*, which gives a natural environment for Grey Francolin (*Coturnix coturnix*) in the semiarid habitats of Tamil Nadu. Priscilla and Jasmine (2002) have also carried out surveys on the distribution and diversity of the Family Phasianidae outside the PA network and have reported that eight species of Galliformes occur outside the Protected Area network in Tamil Nadu.

There are still large gaps in our knowledge on the distribution and ecology of galliformes species. Field surveys and research on galliformes of southern India have to be accorded top priority.

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12.0 Status, Distribution and Management of Galliformes in Andaman and Nicobar Islands

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Introduction

The Andaman and Nicobar Islands (6° 45' - 13° 41' N and 92° 12' - 93° 57' E) in the Bay of Bengal arch from Arakan Yoma in Myanmar in the north to Sumatra in Indonesia in the south (Saldanha 1989, Dagar *et al.* 1991). The Islands cover an area of 8,249 km², with a total coastline of 1,962 km; the Andaman group has more than 325 Islands (21 inhabited) covering 6,408 km², and the Nicobar group has over 23 Islands (12 inhabited) with an area of 1,841 km² (Singh 1981, Saldanha 1989). Islands have a hot, humid and uniform tropical climate and vegetation is mostly evergreen forests and mangrove.

Andaman and Nicobar islands form two of the 218 endemic bird areas of the world with over 270 species of birds (Vijayan *et al.* 2000). Of these, 106 species and subspecies are endemic to these islands. However, the diversity of galliformes in these islands is poor. Of the four species of galliformes that occur in the islands, two species *viz.*, the Blue Peafowl (*Pavo cristatus*) and the Grey Francolin (*Francolinus pondicerianus*) were introduced. The other two *i.e.*, Nicobar megapode (*Megapodius nicobariensis*)

and the subspecies of Bluebreasted Quail (*Coturnix chinensis*), are endemic to Nicobars.

The Nicobar islands can be subdivided into three distinct subgroups based on ornithological affinities (Sankaran 1997). To the south lies the Great Nicobar group consisting of two islands over 100 km² in area, nine islets less than five km² in size, and a few rocks. Great Nicobar, Little Nicobar, Kondul and Pilo Milo are inhabited. Meroe, Treis, Trax, Menchal, Megapode, Cabra and Pigeon are uninhabited islets. Fifty-eight km north of the Great Nicobar group is the Nancowry group (middle Nicobar Islands), which consists of three Islands larger than 100 km², two of 36 and 67 km², three less than 17 km², two small islets and a few rocks. Seven Islands in the Nancowry group are inhabited. Tillanchong is the only uninhabited Island of the group. The northernmost subgroup comprises of Batti Malv and Car Nicobar, which is 88 km north of the Nancowry group. Batti Malv is uninhabited and Car Nicobar has a population of over 19,000 people.

Table 1 : Galliformes of Andaman and Nicobar islands.

S. No.	Species	Status	Distribution	Population status	WPA, 1972	Threats
1	Nicobar megapode <i>Megapodius nicobariensis</i>	Vulnerable (IUCN)	Nicobar islands	Coastal population around 800 breeding pairs	Schedule I	Habitat loss
2	Grey francolin <i>Francolinus pondicerianus</i>	Not known	Andaman islands	Not known	Schedule IV	Least concern
3	Blue-breasted Quail <i>Coturnix chinensis</i>	Common in Nicobars	Nancowry group and Car Nicobar islands	Common in the grassland areas	Schedule IV	Habitat loss
4	Indian Peafowl <i>Pavo cristatus</i>	Rare	Andaman islands	Not common	Schedule I	Least concern



The Nicobar megapode

The Nicobar Megapode *Megapodius nicobariensis*, a mound nesting megapode, is confined to the Nicobar group of Islands in the Bay of Bengal, separated from its nearest congener by a distance of over 1,500 km. The polytypic Nicobar Megapode has two subspecies viz., *M. n. nicobariensis*, distributed in the Nancowry group of Islands north of the Sombrero channel, and *M. n. abbotti*, distributed in the Great Nicobar group of Islands lying south of the Sombrero channel (Hume and Marshall 1878, Abdulali 1964, Ali and Ripley 1983, Fig. 1).

Distribution of the Nicobar megapode

Historically, the Nicobar Megapode occurred on most Nicobar Islands (Hume 1874; Dekker 1992; Sankaran 1995b) barring Car Nicobar (Butler 1899), Chaura (Abdulali 1967) and Bati Malv (Sankaran 1995). There were a few records from the Andaman group of Islands (Hume 1874) and from the Coco Islands further north (Abdulali 1964). None of the records from the Andaman group are of recent origin and the species is now believed to be absent there (Sankaran 1995 a & b). It may have existed on Car Nicobar a century ago but no traces of mounds were found there (Sankaran 1995 a&b). The Island of Chaura is only 11.5 km from Teressa and, considering the megapode's occurrence on the more remote Tillanchong, there is no reason why it should not have existed in Chaura (Sankaran 1995). The presence of what was most probably an ancient mound indicates that the megapode did occur on Chaura historically (Sivakumar 2000). However, both Car Nicobar and Chaura are much too densely populated for the species to exist there now.

Megapodius nicobariensis abbotti Oberholser, 1919

M. n. abbotti is common in all coastal forests, particularly uninhabited or sparsely inhabited areas, on Great and Little Nicobar. It is believed to have disappeared from all areas colonised by mainlanders (Dekker 1992), but they continue to survive in small remnant pockets (Sankaran 1995). Seven of the nine islets in the Great Nicobar group have habitat suitable for megapodes and two (Cabra and Pigeon) are too small. Small populations of megapodes are present on six of these seven islets. The seventh islet, Pilo Milo is inhabited, and the islet is mostly under coconut palms. Megapodes are apparently extinct on this islet. Over 50% of the forests of uninhabited Meroe, Treis, Trak, Menchal and Megapode Island have been converted to coconut plantation, and populations of megapodes on these islands are threatened (Sankaran 1995a).

Megapodius nicobariensis nicobariensis Blyth, 1846

M. n. nicobariensis occurs on seven islands of the Nancowry

group (Sankaran 1995). On Camorta, Katchall and Trinkat, it is patchily distributed, with very few locations having active mounds. Good populations of megapodes exist on Teressa and Bompoka and the density of active mounds is similar to that of Great and Little Nicobar. Tillanchong is mainly hilly with very little level coastal forest, thus megapodes are naturally scarce except in the low lying coastal forests.

Population status of the Nicobar megapode

Of the total 687 km long coastal line of the Nicobar megapode lands, 328 km long coastal forest is identified as the 'Potential Coastal Habitat for Megapode' and remaining 359 km long coastal forests are identified as 'Non-conducive coastal habitat for megapode' (Sivakumar, 2007). Presently, about 800 breeding pairs of the Nicobar megapode occur on the coastal habitat of the Nicobar islands after tsunami, which is nearly 70% less than what was reported a decade before by Sankaran (1995).

Grey francolin *Francolinus pondicerianus*

This species was introduced into the Andaman islands in 1890s. Sporadic sightings of this species were recorded in the deciduous forests especially from the south Andaman. However, detailed distribution and status of this species in Andaman islands is not known. Grey francolin has not been recorded from the Nicobar islands.

Blue-breasted Quail *Coturnix chinensis*

In the Nancowry group of islands of Nicobars, the central portion of the most of islands are grasslands, often extending to the coast itself (Sankaran 1995b). Various explanations exist for the occurrence of these grasslands, the main being that they are man-made. However, there is no historic evidence that colonizers cleared forests for animal husbandry. The existence of the Blue-breasted Quail in these grasslands an indication that these grasslands are so old that not only did colonization take place, but speciation occurred as well. The subspecies *C.c. trinkutensis* present here is believed to be endemic to these islands.

Blue-breasted Quail is common on Car Nicobar, Trinket and Camorta islands. Around 12-15 sightings of this species was recorded during the 1993-94 surveys (Sankaran 1995). During the rapid survey that was carried out in the grasslands of Camorta, Trinket, Teressa and Bamboka islands during June 2006, a total of 54 birds were recorded. Maximum number of birds were recorded in the grasslands of Camorta (29 birds) followed by Teressa, Bomboka and Trinket. Blue-breasted Quail were sighted often with Yellow-legged Buttonquail *Turnix tanki*, whose, sightings was not rare in the Nicobar islands.



Blue Peafowl *Pavo cristatus*

The Blue peafowl is one of the introduced birds in Andaman islands. Their distribution is restricted to in and around the Port Blair and Ross Island in the Port Blair. Total number of Blue Peafowl in Andamans may not exceed 50 individuals.

Threats

Habitat loss and degradation

Habitat loss due to anthropogenic activities appear to be a major cause for the decline in the population of Galliformes. The Nicobar megapode preferred to construct mounds on sandy and sandy-loam substrates of coastal forests, probably because these substrates are easier to dig into, and having superior drainage (Sivakumar 2000, Sivakumar and Sankaran, 2001). The coastal habitat of the Nicobar islands are mainly composed of sand and sandy-loam soil and this would account for the clumped distribution of the Nicobar Megapode towards the coastal region. Coasts are also favoured by human beings who could establish their hamlets surrounded with horticulture crops such as coconut, and areca nut. As a consequence of increasing human population, there is a continuous expansion of the coconut plantation in the coastal areas which has ultimately led to the shrinkage of megapode habitat. Habitat loss remains the single biggest threat to the megapode even after a decade (Sankaran, 1995a). Grassland habitat is another most favourable habitat for people especially after the tsunami for the purpose of housing and plantation. Due to encroachment of grasslands for housing and plantation the Blue-breasted Quail is losing its potential habitats rapidly.

Inadequate Protected Area coverage

The existing Protected Area (PA) coverage is inadequate in the Nicobar islands to safeguard the megapode and Blue-breasted Quail. Currently, less than 40% of potential coastal habitat of megapode is under protection. Out of these, *M. n. abbotti* has been fairly protected in Great Nicobar but *M. n. nicobariensis* was not given much attention earlier and this apathy has pushed this sub-species into the verge of extinction. Tillanchang Wildlife Sanctuary (WS) is the only PA for *M. n. nicobariensis*, covering <3% of total habitat of this sub-species, though 27% of population occur in this island which is uninhabited. Remaining 73% of *M. n. nicobariensis* is not protected and their habitat appears to be under severe threat after tsunami due to post-tsunami rehabilitation process. The largest population of the Nicobar megapode occurs in the Great Nicobar Island. Major portion of this Island is notified as Biosphere Reserve, but has not been properly designed to protect the prime coastal habitat of the Nicobar megapode sufficiently owing to settlement of indigenous

people all along the coastal areas (Sankaran, 1995, Sivakumar, 2007). Entire habitat of the Blue-breasted Quail is out of the PA coverage of the Andaman and Nicobar Islands.

Introduction of Alien Invasive Species and agricultural plants

It is widely known that island ecosystems are particularly vulnerable to alien invasive species, and that their impacts are especially severe (Veitch & Clout 2002) on ground living birds such as galliformes. After tsunami, the State Administration had a plan to supply 400,000 domestic chicken and 9,000 ducks to farmers and tribals which may threaten the native birds including megapode by transmitting diseases. Introduced dogs and cats are also known for threatening egg laying megapodes (Sivakumar 2000). After tsunami, the state agricultural departments initiated several projects as a part of the rehabilitation process, to restore the livelihood of locals including the plantation of cashew in a larger scale in the Nancowry group of islands. This again poses a grave threat to already shrunken habitat of megapodes and Blue-breasted Quail.

Hunting and egg collection

The Nicobar Megapode is protected under Schedule I of the Indian Wildlife (Protection) Act (1972) whereby hunting and trade is prohibited. However, as per the Section 65 of the Indian Wildlife (Protection) Act, 1972, nothing in this Act shall affect the human rights conferred on the Scheduled Tribes of the Nicobar Islands in the Union territory of Andaman and Nicobar Islands by notification of the Andaman and Nicobar Administration, No.40/67/F, No.G635, Vol. III, dated the 28th April, 1967. As per this Act, the ethnic tribes of the Nicobar Islands (Nicobarese and Shompen) are allowed to continue hunting on wild animals including the megapodes.

It was believed that the Nicobarese do not hunt or collect eggs of megapodes extensively because megapodes have spiritual and medicinal values (Sankaran 1995) but this spiritual value seems to be gradually disappearing among tribals (Sivakumar, 2007). Traditionally, Nicobarese are hunter gatherers but in the course of modernisation they have taken to more of horticultural activities and less of hunting. After tsunami, they lost most of the horticulture crops in Great Nicobar, Little Nicobar, Pilo Milo islands and partially in Nancowry group of islands which forced them to hunt whatever they could get from the forest. One to five air guns could be seen in a household and megapodes is one of the favourite birds.

Mainlanders are also known for hunting the megapodes and Blue-breasted Quail. This is borne out by the fact that



areas of mainlander settlement or their presence have no sign of megapodes or highly depleted population, especially in Nancowry group of islands and some part of Great Nicobar. Compared to areas of mainlander settlements, the indigenous people habitations are still recognized as the potential coastal habitat for megapodes and megapodes are seen there. However, this may change in future as lifestyle of native people is gradually matching with that of the mainlanders.

Evidence for megapode hunting *i.e.*, leg traps on or near the mound were also seen near the Shompen-inhabited areas such as Lawful and Trinket Bay of Great Nicobar Island, where several large sized old active mounds were found. Leg traps were also seen in Tillanchang WS possibly by the Nicobarese who occasionally visit this island for coconut harvesting or non-native fishermen who illegally camp here.

Post tsunami impact

The tsunami waves have washed away most of the planted as well as wild coastal coconut and areca nut palms and plantations (Sankaran, 2005) of these have therefore become important for the future survival of tribals in this region. It is very likely that these plantations will encroach the majority of the potential coastal habitats of the Nicobar megapode and its associated species if proper safety measures are not taken in this regard. After tsunami, most of the low-lying coastal areas got submerged and the megapodes had built their mounds in evacuated villages. But on the return of the tribals, the megapodes were hunted. More than 95% of coconut plantations on the southern group of Nicobar islands were washed away, which was the major source of income for tribals. In years to come, it is expected that tribals will be left with fishing and hunting of wildlife for their survival apart from livelihood support from the Government. Each tribal family has one to four air guns. The Nicobar megapode, Pied Imperial Pigeon, Andaman Green Imperial Pigeon, Green Pigeon and Nicobar Pigeon are most favoured by the tribals.

Management perspectives

Management of Habitat

The Nicobar megapode is included in the Schedule I of the Indian Wildlife (Protection) Act, 1972 and this species is considered as globally 'Vulnerable' (IUCN, 2006). This was in response to its dwindling population size and being the flagship species of the Nicobars. Around 70 % of the population of Nicobar megapode had disappeared over the last 12 years (Sivakumar, 2006). The major reason for the sharp decline is believed to be the tsunami which washed away their habitat along with nests. However, habitat destruction and hunting are the major human induced factors

that still adversely affect the megapodes, and these forces are likely to continue until a serious conservation programme is implemented. Restoration of the megapode habitat on the west coast of the Great Nicobar Island is urgently required. Most of the people from this coast were killed by tsunami with the exception of 10 persons who survived in rehabilitation camps. Since west coast of this island is no more suitable for people to live, the entire coastal area need to be included in the existing PA and no plantation projects should be initiated in this region. More than 100 km long coastal line of west coast has a lot of potential to become a better habitat for megapodes as well as other coastal species including sea turtles to nest. A conservation awareness programme needs to be initiated immediately through tribal captains of Nicobarese villages. This programme should clearly address reasons for the decline in Nicobar megapode populations, and how these trends can be arrested or reversed (Dekker *et al.* 2000). Since the habitat destruction is a major human induced cause for the decline of megapodes, it needs to be communicated properly. Further plantation or developmental activities must be contained and expansion of plantation area in forest land should not be allowed. Since there is a strong relationship between poverty, development and wildlife conservation, further developmental activities aimed to eliminate poverty need to be encouraged without undermining the importance of wildlife. Proper Environmental Impact Assessment studies by genuine experts should become a mandatory step prior to initiation of any developmental projects in Nicobar islands. Major developmental/infrastructural projects (for example a proposal to make Great Nicobar a free port for international shipping at the mouth of the Galathea river) should not be considered as they will damage the highly sensitive insular ecosystem and its wildlife. Long-term habitat monitoring in Nicobar islands needs to be initiated with help of experts. A section in the Forest Department should be dedicated exclusively for the research and monitoring part of the wildlife and its habitat.

Review on Existing PA Network for the Nicobar Megapode and Blue-breasted Quail:

At present, two National Parks (NP) and two WSs afford protection to the megapode populations and there are no PAs that holds populations of Blue-breasted Quail. The four PAs that have megapode populations are: Great Nicobar NP, Galathea NP, Megapode WS, and Tillanchong WS. It is recommended that an entire portion of west coast and southern part of the Great Nicobar Island needs to be included in the adjoining NPs as these areas are devoid of human settlement and known to have better habitats for megapodes. This will also protect all other insular fauna of this region including the nesting beaches of sea turtles. Little Nicobar needs to be declared as a 'Conservation Reserve' (CR), so that the degraded habitat can be restored with the participation of local communities. Entire Nancowry



group of islands could be declared as a CR. Since these islands are thickly populated and heavily disturbed, CR concept will help to restore the natural habitat as well as protect wildlife of this region, without jeopardizing the livelihood of local human populations. Indigenous people must be given a major stake in the proposed CRs.

Management of alien invasive species

The symptoms of avian cholera were noticed in megapodes when the outbreak of this disease killed more than 50% of introduced domestic fowl in the Great Nicobar in 1997 (Sivakumar, 2007). After tsunami, the State Administration had a plan to supply 400,000 domestic fowl and 9,000 ducks to farmers and tribals which may threaten the native birds including megapode. Introduced domestic dogs and cats are also known for threatening egg laying Nicobar megapodes (Sivakumar 2000). The following actions are recommended to manage the invasive species in the habitat of megapodes. Awareness programme targeting all stakeholders is required to get support from the local communities to manage the invasive species such as domestic fowl, cat and dogs in Nicobar islands. Immediate removal of all major vertebrate invasive species from the PAs in the Nicobar islands.

Hunting and egg collection

After tsunami, hunting on megapodes seems to be on increasing manifolds. Though, the Nicobarese have traditionally attached cultural value to megapodes, scarcity of animal protein has forced them to hunt megapodes intensively. The two aboriginal tribes of Nicobar islands viz., Nicobarese and Shompens are exempted from the Indian Wildlife (Protection) Act, 1972. Considering the changing lifestyle of these tribes, this immunity should be reviewed. In particular, the Nicobarese should be brought under the purview of the Wildlife (Protection) Act, 1972, while Shompens may be allowed to hunt wild animals. Awareness programme targeting all people through tribal captains needs to be initiated. This programme should clearly address reasons for the decline in Nicobar megapode populations, and how these trends can be arrested or reversed (Dekker *et al.* 2000). Since, hunting is the second major human induced cause for the decline of megapodes, it needs to be communicated properly. Use of air guns should be prohibited in the PAs and in the proposed CRs. Food for guns programme need to be initiated. Guns from the tribal people may be compensated with food by opening up controlled poultry or piggery farms. This will also give alternative employment opportunities to tribal people.

Research and monitoring

Scientific knowledge on the ecology of a species is necessary for *in situ* management of populations. Though, the habitat

use and social organisation of this species is fairly known (Sivakumar, 2000, Sivakumar & Sankaran 2003), it is important to know the factors that govern the population dynamics of this species. Following projects are proposed for future research on this species.

Project 1: Long-term monitoring of the Nicobar megapode and its habitat

Since, information on population trends is essential for understanding the long-term conservation status of this species (Dekker *et al.* 2000), one of the objectives of the current survey was to identify permanent sampling sites to monitor the populations of megapodes for a longer period. In this context, more than 30 transects have been identified which represent various habitats of Nicobar islands and a simple data sheet has been prepared to collect data from this transect. People who have working knowledge of Hindi or English can use this data sheet with one day training. The data collected can be used to highlight particular regions of concern and establish where further conservation effort should be targeted. This project has also been mentioned in the IUCN Megapode Conservation Action Plan (Dekker *et al.* 2000).

Project 2: Population dynamics of the Nicobar megapode

This project is to investigate the viability of small populations by using Population Viability Analysis (PVA) and other models. This project should culminate in a strategic assessment of the best way forward for the long-term conservation of the species. This project has also been mentioned in the IUCN Megapode Conservation Action Plan (Dekker *et al.* 2000).

Project 3: A detailed study on social organization and breeding biology of the Nicobar megapode

Though an intensive study on breeding biology and social organization has been carried out (Sivakumar 2000), it is essential to address several questions that have still remained unanswered, particularly, the survival rate of chicks, solitary birds, process of pair formation, reasons for low clutch size, and multiple mound use of a pair. These aspects need to be investigated.

Project 4: A detailed survey on the Nicobar megapode in interior forests

Till now there was no detailed survey on the megapode population occurring in the interior forests. In the current survey, some transects were laid to look for mounds but the detection probability was very low due to inaccessible terrain and thick vegetation cover. It is essential to know the population size of megapodes inside the interior forests.

Project 5: Habitat use by the Nicobar megapode



A study on this aspect was carried out (Sivakumar 2000), but there has been no investigation on the availability and utilization of food resources. Nest site selection by the Nicobar megapode that occur in interior forests needs to be investigated.

Conclusion

Though the diversity of galliformes in Andaman and Nicobar islands is low, the presence of endemic Nicobar megapode, which is considered to be the flagship species of the coastal forests of Nicobar islands shows the importance of galliformes conservation in the islands. The Department of Forest and Wildlife has taken several conservation actions to safeguard the galliformes especially the Nicobar megapode and its habitats in the islands, which includes the declaration of four PAs in the megapode range. After tsunami, there was an obstacle to carry forward the conservation plan of the Nicobar megapode which could be sorted out as soon as the people are rehabilitated successfully.

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13.0 Status, Distribution and Conservation of Galliformes in Jammu and Kashmir

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Introduction

The state of Jammu and Kashmir is the northern most state of India and its location and the range of altitudes provides for three distinct biomes – the low land dry thorny scrub of Jammu, the mid level temperate evergreen forests of Kashmir and the cold arid climes of Ladakh. Therefore, along with the distinct vegetation types, the regions also exhibit distinct faunal assemblages.

There are no detailed studies on galliformes in the state of Jammu and Kashmir, except for Lamba *et al* (1982), Kaul (1989) and Qadri *et al.* (1990) who documented the distribution and status of pheasants in the Kashmir valley, and Scott *et al.* (1989) in Kishtwar National Park (NP), the only area in Jammu region. Distribution of galliformes has been better documented in Ladakh region by travelers and ornithologists (Pfisher, 2001).

The state has 14 species of galliformes, which includes seven pheasants and others belong to partridge, quail and francolins. Being divided into three clear biogeographic zones the state has species of the Indian peafowl (*Pavo cristatus*) and the Red Junglefowl (*Gallus gallus*), of the cold arid in Tibetan Partridge (*Perdix hodgsoniae*) and the Tibetan Snowcock (*Tetraogallus tibetanus*), and the temperate species such as the Koklass (*Pucrasia macrolopha*), Western Tragopan (*Tragopan melanocephalus*) and the Himalayan Monal (*Lophophorus impejanus*). Only two of the 14 species, the Western Tragopan and Cheer (*Catreus wallichi*) are threatened with extinction globally, although all are included in the Wildlife (Protection) Act of Jammu and Kashmir state.

Status and distribution of galliformes in Jammu and Kashmir state

1. Himalayan monal: It is a commonly occurring pheasant found in almost all Protected Areas (PA) within its distributional range in the state. It can be sighted in good numbers in Limber Wildlife Sanctuary (WS), Dachigam NP, Overa-Aru WS and Kishtwar NP besides other territorial forest areas of the state. No population estimates are available. Main threats were hunting in the past but much of that appears to have been controlled now although they are still trapped in pit-fall traps.

2. Western Tragopan: This threatened species is found at a handful of locations within Jammu and Kashmir state. The largest population is perhaps in the Limber-Lachipora area of the Kazinag range. Western Tragopan is also found in Kishtwar NP and are reportedly present in Sud Mahadev area of Jammu province. Abundance estimates are available from Limber area only which suggests a population of over 45 males. They appear to be fairly secure in Limber area although nothing is known about their status from Kishtwar NP.

3. Cheer Pheasant: The Cheer has a limited distribution in the state. In Jammu area, it is confirmed from Trikuta area while in Kashmir it is found in the Limber WS and Lachipora WS. Southern slopes of the Pir Panjal range need to be surveyed to locate more sites. The species appears to adapt to disturbed habitats and therefore may not be as threatened as thought to be.

4. Koklass Pheasant: This is a relatively common pheasant (as in the other parts of the western Himalaya) and is found in most forested areas of the state. Most significantly, it is found in Overa-Aru WS, Limber WS, Lachipora WS, Gulmarg WS, Dachigam NP and Kishtwar NP. Old records of the presence of this species from Boniyar area of the Kashmir valley (Lamba *et al.*, 1982) are available. Population estimates for this pheasant are lacking.

5. Red Junglefowl: This species is mainly found in the Jammu region of the state and is found in the Ramnagar WS, Jasrota WS and Nandini WS. They are also found in some Reserve Forests of Kathua. This species is largely absent from the valley.

6. White-crested Kalij (*Lophura leucomelanos*): This is also largely confined to the Jammu region of the state and is not found in any significant numbers in the valley although some reports indicate that they may be present in the lower parts of the Jhelum valley. However this needs to be ascertained. The distribution largely follows that of the Red Junglefowl within the state.

7. Indian Peafowl: This species occupies the areas adjacent to the Indian plains and is found in the Ramnagar



WS, Nandini WS and Nagrota WS in the state besides near agricultural farmlands in Sambha and Kathua areas of Jammu. It is not found in the Kashmir Valley or in Ladakh region.

8. Himalayan Snowcock (*Tetraogallus himalayensis*):

This is a high altitude species found in the higher reaches of the state in Ladakh region and also some high altitude areas of the Kashmir valley. It is also found in the higher reaches of Kishtawar NP. However no estimates of abundance are available for this species.

9. Tibetan Snowcock: The Tibetan snowcock is found in only some parts of northern and eastern Ladakh and is thus limited in its distribution within the state.

10. Snow partridge (*Lerwa lerwa*): This species is found in Ladakh and the higher reaches of the Kashmir valley. It may also occur in the Kishtawar NP, but there was no report to suggest this.

11. Chukar (*Alectoris chukar*): This species is spread across all the three provinces of the state and is relatively common in Ladakh and the Kashmir valley, migrating from upper reaches to the valley floor in Dachigam NP. They are also found in other PAs of the state.

12. Black Francolin (*Francolinus francolinus*): This species is predominantly found in the Jammu province. Its recent distribution within the Kashmir valley is not known.

13. Tibetan Partridge: This species is confined to some parts of Ladakh region of the state. Its distribution and status remain largely unknown.

14. Common Quail (*Coturnix coturnix*): This species is believed to occur in the state but no recent records exist. This is perhaps a reflection of less ornithological work being carried out in the state.

Conservation issues:

There are only two species threatened with extinction in the state. The Cheer Pheasant is confined to the Kazinag range where it survives in the Limber WS and Lachipora WS. As apparent from surveys in other areas, Cheer survives well outside PAs also. Thus, we do not perceive any major threats to their population in the state. However, lack of surveys has meant that our knowledge about Cheer is restricted to only the two sites in Kazinag (Kashmir) and Trikuta (Jammu) areas.

The Western Tragopan is, on the other hand more dependent perhaps on the protection to its habitat and is thus safe in Kazinag range (Limber WS and Lachipora WS areas). Their status is unknown in Kishtawar NP though the

potential habitat here is larger than in Limber WS and Lachipora WS. More surveys are required to establish this.

Local hunting must take a toll of pheasant numbers near villages, especially when they are driven down in winters by bad weather. Impacts of such local hunting are not known but since there appears to be no trade in pheasants for meat in the state, this level of hunting should not pose too much of a problem although efforts should be made to stop this as any form of hunting is illegal under the Jammu and Kashmir Wildlife (Protection) Act.

With the security situation in the state improving, it is expected that more surveys will now be undertaken and a more meaningful assessment of distribution and status of galliformes of the state will be available, for without such information, it is difficult to prepare better conservation plans.

Conservation Recommendations

The state is rich in galliformes and it is time that a concerted survey be undertaken to map the distributions of all the species. The state harbours a significant population of Western Tragopan and thus has an important role to play in its conservation globally and also in the national context. The main populations of this species need to be identified and protected from threats of habitat loss and hunting. Creating public awareness about galliformes by establishing state of the art display facilities could be one of the main tasks of the Department of Wildlife Protection, Jammu & Kashmir Government in the coming years. Keeping colourful pheasants such as Himalayan monal in well maintained aviaries with proper information could generate some awareness about this group of birds. The Department of Wildlife Protection could also join in the conservation breeding efforts of the Western Tragopan initiated by the Department of Forest and Wildlife, Himachal Pradesh and the Central Zoo Authority.

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14.0 Status, Distribution and Management of Pheasants in Himachal Pradesh

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Introduction

The mountainous state of Himachal Pradesh, with elevations ranging from 300 to over 6,000 m, accounts for 17% of the area of the north-western Himalaya. Biogeographically the state can be divided into four distinct regions: the Trans-Himalaya (Biotic provinces 1A & 1B), which include the cold deserts of northern Lahul and Spiti districts; the Greater Himalayas (Biotic provinces 2A & 2B), high and middle mountains covering most of the state; and the semi-arid zone (Biotic province 4A), consisting of the hot dry foot hills in the south (Rodgers & Panwar 1988). The biotic provinces 2A (North-west Himalaya) and 2B (Western Himalaya) have species of international conservation significance such as the Western Tragopan and Cheer (Rodgers & Panwar 1988). Two National Parks (NP) and 32 Wildlife Sanctuaries (32) have been set up so far in Himachal Pradesh covering 10.37% of the state area with proposals for new PAs that would add another 1.08% coverage (Rodgers *et al.* 2000).

The rugged terrain and clearly distinct agro-climatic/physiographic zones in the state harbour area specific flora and fauna. Pheasants form an important component of the Avian diversity of Himachal Pradesh. The Himalayan Monal (*Lophophorus impejanus*), Kalij (*Lophura leucomelana*), Cheer (*Catreus wallichii*), Koklass (*Pucrasia macroplopha*), Western Tragopan (*Tragopan melanocephalus*), Red Junglefowl (*Gallus gallus murghi*), and the Indian Peafowl (*Pavo cristatus*) are the seven pheasants of Himachal Pradesh. These spectacular birds of Himachal Pradesh are known through the fragmented surveys carried out in the past. The areas surveyed or studied so far are in Kullu, Shimla Hills, and parts of Chamba. The non-availability of information from other areas is perhaps for lack of surveys. Species such as the Western Tragopan occurs in rugged and inaccessible areas that makes its survey rather difficult. Similarly, although Cheer Pheasant is quite common in their grassland habitat, so far only a few studies have been carried out. In this report, we present the information on the status and distribution of the pheasants of Himachal Pradesh.

Status and distribution

Himalayan Monal (*Lophophorus impejanus*)

A conspicuous pheasant, that is very well known to the local villagers and calls often recorded by the treckers. The Monal, was the former state bird of the Himachal Pradesh and is found throughout the middle Himalayan range between 2,000 and 3,500 m depending upon the season. Locally, it is known as *Bnal* (male), *Bodh* (female) or *Kardi* (female), in Shimla, Kullu and Pandrabis areas; and *Dang* in Kinnaur district. The local people consider it chivalrous to adorn their caps with its crest which is made of wire-like spatula tipped feathers and meat. In Kullu district, density of calling male Monal has been recorded between 1-10/km². The best sightings of Monal have been made in Shimla hills and the upper Beas Valley between 2,600-3,150 m. However, the front ranges of Himalayas nestling Shimla Water Catchment area which during British time had Monal populations are now devoid of this pheasant. The nearest Monal reported in this area is from Hatu peak above Narkanda. Based on a study in Great Himalayan NP from 1995-1998, Ramesh *et al.* (1999) reported Monal Encounter Rates to range from 1.5 to 3.9 birds/km walk. During a 5 km walk through Kharus Oak *Quercus semicarpifolia* forests from Majhan to Apgain thatch of Jiwa Nal in Great Himalayan NP, 42 Monals were flushed in the month of November 1990, and 62 Monals were flushed in mid-December. The first author could easily count 20 to 25 birds during six km walk up to Dhela meadow (from Shakti side) in Sainj catchment during spring and autumn surveys from 2003 to 2006. Surveys in the PAs of Kanawar, Rupi-Bhaba, Daranghati, and Talra suggest 3-7 birds/km².

Kalij (*Lophura leucomelanos*)

The White-crested Kalij is widely adapted to diverse altitudinal zones from 550m of Dadoha forests of Kangra district (near Pong Dam Lake) to 2,700m in Kinnaur district. Locally, it is



known as *Kalesa*, *Kansha* or *Kolsa* in Shimla, Solan and Pandrabis areas of the Sutlej catchment; and *Panti* or *Kulsu* in Kinnaur district. This pheasant is characteristic of the front ranges of Himalayas rather than the interior valleys where it is fairly distributed in the altitudinal range 1,800-2,650m, in pure Ban Oak *Quercus leucotrichophora* forests as well as mixed forest of Deodar *Cedrus deodara*, Blue Pine *Pinus wallichiana* and Kharsu oak, especially on northerly aspects. Substantial populations of Kaleej exist at Ghanahati, Great Himalayan NP, Tara Devi, Shimla Water Catchment WS, Chail WS, Daranghati WS and Pandrabis which have roosting trees as well as open scrub and cultivations in vicinity. With most birds being seen in disturbed forest close to human habitation, there appears to be a positive association between people and Kaleej. The Kaleej were mostly sighted or heard at dawn or dusk. Its tolerance to biotic pressures to an extent would help it survive in its present distribution range in Himachal Pradesh. SP has been sighting Kaleej on regular basis near Blossom in Chail WS; on the campus of Community Training and Tourist centre in Sai Ropa (Tirthan) and on National Highway near Ghanahatti (Shimla district).

Cheer Pheasant (*Catreus wallichii*)

This IUCN Red Data listed endangered pheasant is found on the grassy slopes of Shimla hills, and the upper Beas Valley. The Cheer pheasant seems to be well distributed in its potential habitat in the state. In Shimla and Pandrabis areas it is known as *Tana* which in local parlance refers to deaf. The local people are well acquainted with the behaviour of the bird which hides itself in the grasses and does not take to wings unless one has reached very close. *Cheera*, *Cherus*, *Chagan* or *Chura* are its local names in Kinnaur district. Its altitudinal distribution range in Himachal Pradesh is 1,600-2,500 m, mainly on steep, south facing, grassy slopes with Chir Pine (*Pinus roxburghii*) trees or scrub vegetation. This pheasant has an amazing ability of responding to the amplified broadcast of pre-recorded Cheer calls which has allowed the discovery of several new sites. The first author has seen and heard Cheer pheasants in Tirthan and Sainj catchments of the Great Himalayan NP. The Chail WS, Budhil Nalla in Chamba, and the upper Beas Valley have viable populations of Cheer. More than a thousand pairs of Cheer are expected to occur in Himachal Pradesh. New Cheer sites have been discovered in Kinnaur district which may perhaps represent the present northern limit for this species in Himachal. Many encouraging reports are there about more number of Cheer sites. There is an urgent need for dedicated surveys in these promising sites.

Koklass (*Pucrasia macrolopha*)

The Koklass owes its name to the crow of the cock which is a loud ringing but unmusical *kok-kok-kok.. kokras*. Its local name in Shimla and Pandrabis areas is *Plash*, *Khwaksha* or

Koklas; and in Kinnaur district the bird is known as *Khwaksha*. It prefers dense undergrowth in Fir-Spruce forest, though it occurs in Oak-Deodar areas, too. The dawn chorus of the pheasant can be heard for most of the year except late summer. This pheasant could be commonly observed between 2,400-3,100 m. During recent surveys, koklass could be heard at 3,500 m in Gumtarao, and Basu forests in Tirthan catchment in spring and autumn surveys from 2003 to 2006. The bird could sporadically be seen below 2,000 m. An estimated density of at least five pairs/km² and a minimum population of 3,000 pairs are expected to occur in 600 km² area of the upper Beas region. Another significant locality for Koklass is Shimla Water Catchment Area which is under total protection since 1890. A census effort in 1979 gave an estimate of 17-25 pairs/km² which is highest reported density under natural conditions for this bird. The bird is in better status in Shimla Water Catchment WS although fresh surveys are required to be undertaken there. Ramesh *et al.* (1999) reported Koklass Encounter Rates to range from 0.3 to 1.4 birds/km walk in Great Himalayan NP during the years 1995-1998. The survey efforts in the Great Himalayan National Park over past five years suggest an increase in Koklass populations.

Western Tragopan (*Tragopan melanocephalus*)

The western tragopan is also known as *Jujurana* in Kullu district of Himachal Pradesh means 'king of the birds'. According to a local legend the God created this colourful pheasant with the help of the most beautiful feathers of each bird in the universe. The name relates to the grandeur and beauty of Western Tragopan that it enjoys among the local villagers. It is now the State Bird of Himachal Pradesh. It is known as *Pyara* in Kinnaur; *Jyazi* in Bushahr, and *Fulgar* in Chamba and Kangra districts. The world distribution of Western Tragopan is limited to parts of Pakistan, Jammu & Kashmir, Himachal Pradesh and Uttarakhand. Its confirmed eastern limit of distribution is Uttarkashi in Uttarakhand. This pheasant has been well documented from the Great Himalayan NP, Rupibhaba WS and Daranghati WS in Himachal Pradesh.

The latest reports of Western Tragopan come from the surveys in Sutlej and Beas catchments. The Thar Jot site near Daranghati WS is the first definite site for Western Tragopan reported for over 30 years east of the Sutlej. The Thar Jot area has primeval forest of Deodar *Cedrus deodara*, Fir *Abies pindrow*, and Spruce *Picea smithiana* with a thick understorey of *ringal* or montane bamboo *Arundinaria falcata*. This is a typical Western Tragopan habitat between 2,500 and 3,300 m altitude which does not appear to tolerate biotic disturbances. Such type of Western Tragopan habitats now exist in interior forests of Himachal, most of which are part of the PAs. A Danish photographer and birder visited Daranghati WS in May 2006 and saw 16 different birds. In December 2006, 15-20



birds were heard/seen/flushed in the same area. The local communities also know the Western Tragopan as '*sing wala panchi*' or the Western Horned Tragopan. In Great Himalayan NP, the first author has seen Western Tragopan in the forest around Dhela meadow in April 2004 and heard more than four birds calling in Basu forest in March 2006. Ramesh *et al.* (1999) reported Western Tragopan Encounter Rates to range from 0.1 to 0.3 birds/km walk. The Sarahan Bushahr pheasantry in Shimla district is the only facility in the world that houses two breeding pairs of Western Tragopan in captivity.

Red Junglefowl (*Gallus gallus*)

This bird occurs in the foothill areas of Himachal Pradesh in the districts of Kangra, Bilaspur, Una, Solan, Sirmaur and Hamirpur mainly below 1,200 m. The forest patches in these districts with heavy undergrowth support good populations despite biotic interference. This species mainly occurs in subtropical dry evergreen forest of low Shiwalik ranges to the south of Kangra district (Gaston *et al.* 1981). The bird was observed in Damtal, Masrur, Jwalamukhi forests quite frequently. The observations on this bird need to be more systematic. There is a lack of serious survey effort for this species. Some preliminary observations have been made at Simbalbara Wildlife Sanctuary in Sirmaur district. WII has recently initiated a study on the status, ecology and genetics of Red Junglefowl in India which includes investigations in Himachal Pradesh also.

Indian Peafowl (*Pavo cristatus*)

In Himachal Pradesh, the Indian Peafowl is uncommon. It was observed in 1985-86 in Dehra-Gopipur during bird-watching trips (Pandey 1989). Himachal Wildlife Project, 1981 reports it from Chaini and Bandal in the Tirthan valley. There is a report of peafowl from Haritalyanger in 1970, and from Ganahatti in 1978 in Ban Oak forest (Gaston *et al.* 1981). The first author could record a population of 20 to 30 birds from Pah Nala in

Khokhan WS in 1990-91. Peafowl has been reported from Kashla village in Nargu WS (M.S. Jain, *pers. comm.*). The latest peafowl reports are from Sai Ropa in Tirthan Valley where at least three males are heard calling at twilight since March 2006. The sites of Haritalyanger in Bilaspur district, Sainj on Sutlaj river near Rampur Bushahr have been reconfirmed for peafowl in 2005 and 2006.

Conservation and Management

Habitat loss and degradation due to anthropogenic pressures are the major threat to the pheasants in Himachal Pradesh. Apart from establishing the network of PAs, the state is striving hard to reduce habitat degradation and disturbances to pheasants due to human use. The state has also carried out state level monitoring of pheasants that included training of forest and wildlife staff. *Ex-situ* conservation programmes for pheasants in the state have been very successful and are well appreciated.

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15.0 Status, Distribution and Management of Galliformes in Uttarakhand

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Introduction

Uttarakhand is India's youngest mountain state, carved out of erstwhile Uttar Pradesh on 9th November 2000, and spreads over 53,483 km² (1.67% of India's geographical area). The state has diverse habitats ranging from the snow bound peaks of the Himalayas, the highest being Nanda Devi (7,817 m), to the sub-tropical terai region. This diversity has also contributed immensely to the diversity of flora and fauna of the state. As per the biogeographical classification by the Wildlife Institute of India, the state represents the Biogeographic Zones 2B Western Himalaya and 7B Shiwaliks (Rodgers *et al.* 2000)

Uttarakhand has a rich conservation history. Forests are an integral part of the ecological assets of the state. The state's recorded forest area is 34,650 km² which is 64.8% of the state's geographical area and 4.5% of the national forest area. Its forest cover is 24,465 km² which represents 45.74% of the geographical area of the state and 3.61% of the forest cover of the country.

As its commitment to conservation of this valuable natural resource, the state has set aside over 12% of its geographical area (26.6% of its forest area) as National Parks (NP) and Wildlife Sanctuaries (WS), which is way above the national average. The details of the Protected Areas (PA) of the state are printed in the Table 1 and 2.

Uttarakhand is a rich in avifauna. Of the 1,248 species of birds reported from India, over 621 have been reported from Uttarakhand (Mohan and Sinha 2003). Of these, galliformes have pride of place. In the present conservation scenario that is essentially "large mammal" centric, little information is available on the actual conservation status of a group of birds such as the Galliformes from Uttarakhand. Most of the information is secondary and often based on anecdotal evidences. However, within these limitations, an attempt is being made to make an assessment of the status of these species in the state.

Table 1 : National Parks and Wildlife Sanctuaries of Uttarakhand

	Name of National Park (NP) / Wildlife Sanctuary (WS)	Year of Estt.	Area (km ²)	Climatic/ Altitudinal Zone
1	Corbett NP	1936	521	Tropical.
2	Rajaji N.	1983	820	Tropical
3	Nanda Devi NP	1982	630	Alpine
4	Valley of Flowers NP.	1982	87	Alpine
5	Gangotri NP.	1989	1,553	Alpine
6	Govind NP	1990	472	Alpine, Subalpine, Temperate
7	Kedarnath WS	1972	957	Alpine, Subalpine, Temperate
8	Govind WS	1955	481	Alpine, Subalpine, Temperate
9	Banog WS	1993	11	Temperate
10	Binsar WS	1988	46	Temperate
11	Askot WS	1986	600	Subtropical to Temperate
12	Sonanadi WS	1987	301	Tropical.
TOTAL			6479	



Table 2 : Conservation Reserves of Uttarakhand

S. No	Name of Conservation Reserve (CR)	Year of Estt.	Area (km ²)	Climatic/ Altitudinal Zone
1	Jhilmil Tal CR	2005	37.83	Tropical
2	Asan Wetland CR	2005	4.44	Tropical
TOTAL			42.37	

Status and distribution of Galliformes in Uttarakhand:

The Red Junglefowl (*Gallus gallus*)

In Uttarakhand, the sal forests of the terai are the main stronghold of the Red Junglefowl distribution. While commonly seen in Corbett NP and Rajaji NP and the Sona Nadi WS, it is also fairly abundant in other forest tracts of the terai region in the state. There is no detailed information about their population status in the state. Towards the forest edges, the species can be seen occurring in close proximity to human habitations, which in turn has raised concerns about the interbreeding of the wild with domesticated varieties. The Wildlife Institute of India (WII), Dehradun has initiated a project to evaluate the genetic diversity and other ecological and behavioural aspects of the species in Uttarakhand.

The Indian Peafowl (*Pavo cristatus*)

Although no population estimates are available, the species is abundant in the terai region of the state. It is seen in good numbers in PAs such as the Corbett NP and Rajaji NP. The Jhirna-Kalagarh road is one of the best places to see large number of these birds during an early morning or late evening drive through the forests. It is also seen in good numbers on forest edges close to human habitations. Due to its religious connotations, the species is generally tolerated, despite occasional complaints about its damage to crops.

The Himalayan Monal (*Lophophorus impejanus*)

The Himalayan Monal is the State Bird of Uttarakhand and it has a significant presence in the Nanda Devi NP, Valley of Flowers NP, Govind NP, Gangotri NP, Kedarnath WS, Askot WS, and Govind WS. It is also reported from the Chakrata, Badrinath, Bageshwar and Pithoragarh Forest Divisions. The Kedarnath WS in particular, has several excellent locations for sighting of this beautiful bird. Shokharkah, near Tungnath is one such site where patient waiting is usually rewarded by sightings of upto 20-30 individuals in one evening. Encounter rate for monal in this area ranges from 0.7 to 1.2/ km walk and the density estimate ranges from 5 to 20 pairs/km² (Sathyakumar *et al.* 1992). Madhmaheshwar in Kedarnath WS and nearby areas are also good areas for

sighting of monals. In Nanda Devi NP, the encounter rate for monal range from 0.75 to 2.28/km walk (Sathyakumar 2004).

Kalij Pheasant (*Lophura leucomelanos*)

Of the five sub species of Kalij distributed along the Indian mountain states, Uttarakhand is home to the White crested Kalij (*L.l.hamiltonii*). The species exhibits a wide altitudinal distribution, from about 200 to 2,800 m. Thus, in several places it is sympatric to the Red Junglefowl. The species is common in the temperate forest areas of the state, with Kedarnath WS, Binsar WS, Govind NP & WS and Askot WS some of the prominent areas bearing good populations. The Mandal-Chopta road in Kedarnath WS is one of the best places to sight this bird. Abundance estimates for Kalij in this area are 8.6 birds/km walk and 16 to 17 birds/km² (Sathyakumar *et al.* 1992). It is also seen easily on the foothills and hill sides of the Corbett Tiger Reserve.

Cheer Pheasant (*Caterus wallichi*)

The cheer pheasant generally occurs in small and isolated populations. In Uttarakhand, the species is generally rare, reported infrequently from open grassy and scrubby tracts on steep hillsides between 1,500 to 2,500 m. Areas near Lansdowne in Pauri Garhwal district report occasional sightings of the bird. Other areas from where the species has been reported includes parts of Nanda Devi Biosphere Reserve, Kedarnath WS, Govind NP & WS, Tehri and Uttarkashi Forest Divisions. The species continues to be rare with very limited information on its status.

Koklass Pheasant (*Pucrasia macrolopha*)

This species occurs in well forested tracts between 2,500 - 3,300 m in temperate forests. In Uttarakhand, the Chopta-Mandal road stretch and the forest tracts around Tungnath are well known locations to spot the bird. Green (1986) estimated koklass density as five birds/km² in Shokharkh area in Kedarnath WS. Other notable areas for the species include parts of Uttarkashi, Tehri and Bageshwar Forest Divisions and the Binsar, Govind WS & NP. In Dibrugeta, Nanda Devi NP, the abundance of Koklass was estimated as 3 calling males/ station during spring 2003 (Sathyakumar, 2004).

**Satyr Trogon (Trogon satyra)**

The main stronghold of the Satyr Trogon is the Eastern Himalayas. However, the species is also reported from parts of Uttarakhand. Sightings are extremely rare and have been confined to some reports from the Pithoragarh, Almora and Bageshwar Forest Divisions and the Askot WS.

Snow Partridge (Lerwa lerwa)

The snow partridge, as its name suggests, generally occurs close to the snowline. It can be seen in good numbers, upto 25-30 individuals in places such as the Govind WS, Valley of Flowers NP, Nanda Devi NP and Kedarnath WS. It is also sighted in the high altitude areas of the Uttarkashi and Bageshwar Forest Divisions.

The Himalayan Snowcock (Tetraogallus himalayensis)

More common than the Snow partridge, it occurs in Alpine pastures near the snowline and bare stony ridges and steep slopes but uncommon below the 4000 m. This species is restricted to the Trans-Himalayan tracts of Uttarakhand largely in Nanda Devi Biosphere Reserve and Gangotri landscape. In Nanda Devi NP, the encounter rate for this species was 1.33/km walk (Sathyakumar, 2004).

Chukar (Alectoris chukar)

The Chukar partridge is well distributed in Uttarakhand and it is fairly common in some localities. It occurs mainly in open and rocky hill slopes and stony ravines, often near a water source. They exhibit an altitudinal movement from about 1,200 m to 4,000 m in the Uttarakhand Himalayas.

Black Francolin (Francolinus francolinus)

The Black Francolin is a common bird of the hillsides in Uttarakhand. It is seen around tall grasses and scrub, abandoned agricultural lands near villages. Best seen in the Corbett NP, it is often more heard than seen, its loud, harsh call distinctly reminding others of its presence.

Tibetan partridge (Perdix hodgsoniae)

This species is occasionally reported from the Trans-Himalayan region of the Nanda Devi Biosphere Reserve and Uttarkashi Forest Division, where it inhabits rocky slopes with *Caragana* shrubs. Its status in Uttarakhand is best described as rare.

Hill Partridge (Arborophila torqueola)

This species is best reported from the hill slopes and ravines

of oak forests in Uttarakhand. It is fairly common, though no scientific estimation of its status is available.

Rufous-throated Partridge (Arborophila rufogularis)

The species looks similar to and its range also sometimes overlaps that of the Hill Partridge. It is locally common in well forested patches of the state such as Binsar WS, Askot WS and in Pithoragarh and Bageshwar Forest Divisions.

Himalayan Quail (Ophrysia superciliosa)

This remains the endearing mystery of the galliformes in Uttarakhand. The species was last reported in 1890 but it is believed to still survive somewhere in Uttarakhand. The Banog WS in Mussoorie provides protection to one of the last known sites of this species. Since then, many attempts have been made to establish the presence of the species, including more recently by analysing feathers collected from probable sites of occurrence. During the last 10 years, many claims have been made of sightings of the Himalayan Quail, none substantiated. The anticipated re-emergence of the species is the subject of much debate.

Management Concerns:

Despite many of the pheasant species finding protection cover under the provisions of the Wildlife (Protection) Act 1972, their feathers and plumes attract many buyers. One of the major issues for the conservation of Galliformes, especially pheasants, is that the various developmental activities across the state that attract a large number of migrant labour who live virtually unsupervised in many interior areas. They are known to occasionally trap these birds for food, also occasionally for the crest and feathers. The monal crest is proudly worn as traditional attire in some parts of Himachal Pradesh and commands a fancy price. In addition to the core issues of degradation of habitats, their fragmentation is also cause of concern. There is very limited information on the conservation status and requirements of these species, which are seen as indicators of the ecological health of the ecosystem.

Many of these species occur equally outside the PA network as within. Even within the Forest Department, there is a lack of financial and technical resources to implement scientific species management or habitat recovery programmes for such species. The extremely remote and rugged terrain, harsh climatic conditions, along with a severe lack of trained and motivated staff to implement management actions are the constraints for better management in the state.

Cattle rearing is a major economic activity in many parts of the state. This along with grazing by sheep, goat and cattle



in the higher grasslands of the state by migrant graziers and herderspersons from neighbouring states are major concerns for preventing habitat degradation and disturbances to galliformes. Given that the galliformes are ground dwellers, the adverse impacts of heavy grazing on their critical habitats and during breeding season can not be underestimated.

Forest Fires are also an important adversarial influence on Galliformes conservation in the state. Usually, the loss of ground dwelling birdlife during fires is not documented or even less understood but the potential impact on the population of these bird species is grave.

There is no planned Conservation Breeding Programme in place for Galliformes as of now in Uttarakhand but such an exercise is being planned at a suitable site in Kedarnath Wildlife Division.

Galliformes of Uttarakhand hold a great ecological value and also occupy an important place in the cultural ethos and heritage of the state. More concerted efforts, beginning with awareness as the first step, are needed to ensure the continued well being of these beautiful gifts of nature.

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16.0 Status, Distribution and Management of Galliformes in West Bengal

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Introduction

The State of West Bengal (88,752 km²) extends from the Himalayas in the north to the Bay of Bengal in the south, and owing to this varying elevation range, it supports rich biodiversity. The Darjeeling hills forms a part of the eastern Himalaya and includes Sandakfu—the highest peak of the state. The narrow Terai region separates this region from the plains, which in turn transitions into the Ganges delta towards the south. The Rarh region intervenes between the Ganges delta in the east and the western plateau and high lands. A small coastal region is on the extreme south, while the Sundarbans mangrove forests form a remarkable geographical landmark at the Ganges delta. Forests make up 14% of the geographical area of West Bengal, which is lower than the national average of 23%. Protected forest cover is 4% of the state area. About 19 species of galliformes occur in the West Bengal and the state has taken several management programmes to conserve these birds. Almost all the galliformes in the state have been protected by declaring their habitat as Protected Areas (PA), however, larger populations of galliformes are still occur outside the PAs, which is a major challenge in conservation of these birds in the state. In this article, I present some information on the status and distribution of galliformes in the state of West Bengal.

Status and distribution of galliformes

The **Red Junglefowl** (*Gallus gallus*) is one of the most well known pheasants of West Bengal as it is the most widespread, occurring in the foothill forests of the Duars and Terai, in the Sal forests of western hilly lateritic tracts, and also in the mangroves of Sunderbans. Though this species is widely distributed in the state, so far there has been no detailed survey to assess the status of this species.

The **Indian Peafowl** (*Pavo cristatus*) is common in many National Parks (NP) and Wildlife Sanctuaries (WS) in the Duars and Terai in northern West Bengal such as the Mahananda WS, Garumara NP, Jaldapara WS and Buxa Tiger Reserve (TR). Small populations still survive in the forests of Purulia and Bankura districts. There is a small population surviving near Bandel, that probably originating from an escaped population in Rajhat, Hooghly district.

The **Green Peafowl** (*Pavo muticus*) was reported from Jalpaiguri district in 1957, but it was not sighted again in

West Bengal, and so would have probably become locally extinct here.

The **Kalij Pheasant** (*Lophura leucomelanos*) is commonly seen in the undisturbed forests in Darjeeling hills during dawn or dusk. It is also common in the Singhalila NP and Neora Valley NP.

The **Blood Pheasant** (*Ithaginis cruentus*) found in the high altitudes (>3,200m) such as in Singhalila NP near Sandakphu.

The **Satyr Tragopan** (*Tragopan satyra*) inhabits steep hillsides mainly between 2,600–3,800 m. It prefers moist oak and rhododendron forests with dense undergrowth and bamboo clumps. In West Bengal, it is found in the Singhalila NP and Neora Valley NP. It is a 'Near Threatened' species and needs protection for its long-term survival.

The **Hill Partridge** (*Arborophila torqueola*) inhabits ravines and slopes in undergrowth of moist, dense forest of oak and other evergreen broadleaves such as in Lava and Luagaon area and in Neora Valley NP. They are more often heard than seen particularly during their breeding season (April to July).

The **Rufous-throated Partridge** (*Arborophila rufogularis*) is also found in the same area as the Hill Partridge but usually at lower altitudes.

The **Chestnut-breasted Partridge** (*Arborophila mandelli*) is a rare bird recorded from Singhalila NP and Buxa TR. It is found in dense undergrowth in broadleaved evergreen forests.

The **Red Spurfowl** (*Galloperdix spadicea*) is rare in West Bengal and occur in the dry forests of stony, scrubby foothill country and bamboo jungle cut up by watercourses and overgrown with brushwood – a habitat that is now rare in West Bengal.

The **Painted Spurfowl** (*Galloperdix lunulata*) occur in the same area where Red spurfowl is distributed but prefers drier habitats in thorn scrub and bamboo thickets.

The **Black Francolin** (*Francolinus francolinus*) is often



encountered around cultivations, in tall grass and in scrubs in both hills and plains. At present, it is rare in West Bengal.

The **Grey Francolin** (*Francolinus pondicerianus*) is still common in certain areas in the western part of West Bengal. It prefers open country and scrub lands.

The **Swamp Francolin** (*Francolinus gularis*) is a Globally Threatened species because it prefers to live only in tall wet grasslands and swamps, a habitat, which is scarce at present. It has been recorded from Buxa TR and Gorumara NP. It used to be found in the Sunderbans and even in the Salt Lake area near Kolkata in the past, but there are no recent records as tall grasslands have vanished from these areas.

The **Common Quail** (*Coturnix coturnix*) widespread in the plains of the northern part of the state, but probably not common. It prefers standing crops, paddy stubbles and grasslands and tall and dense vegetation.

The **Rain Quail** (*Coturnix coromandelica*) is also found in some areas of northern West Bengal. It prefers habitats similar to that of the Common Quail.

The **Blue-breasted Quail** (*Coturnix chinensis*) is uncommon in West Bengal. It prefers wet habitats such as wet grassland, marshes, paddy field edges, dense grass at roadsides and scrub.

The **Jungle Bush Quail** (*Perdica asiatica*) occurs in the western most part of West Bengal. It prefers dry grass and scrub jungle and both open and fairly dense deciduous forests, preferably on dry and stony ground.

The **Painted Bush Quail** (*Perdica erythrorhynchos*) is rare in West Bengal and found in small numbers in the western most part of the state. It prefers thin scrub and scrub at forest edge.

Conservation perspectives

Habitat loss and degradation have threatened the survival of the Galliformes all over their range in the state. Excessive biotic pressures on the forests have led to the degradation as well as reduction in numbers of wild fauna in the state. Developmental activities, road and railway construction have also led to habitat loss and degradation in some areas. Grasslands are also subjected to intense pressures from encroachment for settlements and cultivation, over-grazing by domestic livestock, grass harvesting, fire and tree plantation. Galliformes are also poached in some areas by local people for meat.

The state has 4,031.km² of forests, under PA network which is 34% of the State's total forest area and 4.54% of the total geographical area. The PA network includes 1,055 km² that are covered under 15 WSSs, 1,693 km² that are covered under the five NPs, and the rest fall in the buffer zones of the two Tiger Reserves, and 1 Biosphere Reserve. These PAs and the Territorial Forest Divisions afford protection to several species of galliformes in the state. West Bengal has been a pioneer in the concept of Joint Forest Management (JFM) for protection of forest resources. This has lately been modified for PAs to be known as JPAM. The concept is being tested and modified constantly in the eco-development activities around the PAs which will ultimately help in the conservation of wildlife including galliformes.



17.0 Status, Distribution and Management of Galliformes in Sikkim

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Introduction

One of the smallest and least populous states in India, Sikkim lies between 27°5' to 28°9' N and 87°59' to 88°56' E, covering an area of 7,096 km². Located between the Himalayan kingdoms of Nepal in the west, by the Singalila mountain chain culminating in the mighty Khangchendzonga range at over 8,598m, the world's third highest peak and Bhutan in the east by the Chola Range, Sikkim is bounded by Darjeeling District of West Bengal to the south and a stretch of trans-Himalayan Tibetan Plateau in the north. Sikkim is classified as part of the biogeographic province 2C Central Himalayas, with Temperate Broad-leaf biome, and the north of Sikkim as biogeographic province 1B Trans-Himalaya-Tibetan plateau (Rodgers *et al.* 2000).

Forestry is the major land use in the state and over 80% of the total geographical area of the state under the administrative control of the Department of Forests, Environment and Wildlife management (DFEWL). The total forest land of the state is 5,765 km², *i.e.*, 50%, while total area under tree cover is 3,129 km², *i.e.*, 44% of the total geographical area (Anon, 2002). This figure is one of the largest in the country. There is one high altitude National Park (NP) cum Biosphere Reserve (BR) and seven Wildlife Sanctuaries (WS), which together constitute 42.6% of the total geographical area (Table 1A). The proposal for new Protected Areas (PA) in the state (Table 1B), would further strengthen the status of Sikkim as the state with the best PA network in the country.

Table 1A: Wildlife Protected Areas of Sikkim

Name of the PA	District	Area in km ²	Date of Notification
National Park (NP)			
1. Khangchendzonga NP	North and West	1,784	26.08.1977
Wildlife Sanctuaries (WS)			
1. Shingba Rhododendron WS	North	43	05.12.1992
2. Barsey Rhododendron WS	West	104	08.06.1996
3. Kyongnosla Alpine WS	East	31	05.12.1992
4. Fambong Lho WS	East	51.76	02.04.1984
5. Maenam WS	South	35.34	09.03.1987
6. Pangolakha WS	East	128	07.11.2002
7. Kitam WS	South	06	03.02.2005

Table 1B : Proposed PAs of Sikkim

Name of the PA	District	Area in km ²
1. Tso Lhamo Cold Desert Conservation Reserve	North	c. 975 km ²



Status and distribution of galliformes in Sikkim

The Blood Pheasant *Ithaginis cruentus* is the State Bird of Sikkim. So far only one survey was conducted exclusively for Galliformes in Sikkim. However, several opportunistic sightings of galliformes were recorded during the following departmental research surveys from 1988-2005. Information from these was used in relevant short publications, papers presented during seminars or as short unpublished departmental reports.

- Asian Waterfowl Count in the Trans-Himalayan and alpine regions of north and east Sikkim, 1988-1994.
- Short surveys for butterflies in all four districts, 1988 - 1994 (information used in Haribal, M. 1992).
- Cold desert wildlife surveys in north Sikkim 1988, 1991-1995.
- Survey of birds of Fambong Lho Wildlife Sanctuary, east Sikkim, 1989.
- Wildlife expedition to Lhonak Valley-Green Lake, north Sikkim, 1990.
- Wildlife survey of Lhonak Valley, Lashar Valley and Tso Lhamo Plateau, north Sikkim, 1992.
- Wildlife survey including bird ringing studies at Lashar-Sebu La-Yumesamdong-Tembawa and Dongkia La-Tso Lhamo Plateau, 1995.
- Royal Botanic Garden Edinburgh expedition to Lashar-Sebu La-Yumesamdong-Tembawa and Lachung Valley, north Sikkim, Fambong Lho WS, east Sikkim, July 1996.
- Oriental Bird Club bird survey in Kitam and lowland forests, south Sikkim and Barsey Rhododendron Sanctuary, west Sikkim, Mar-Apr and Sep-Oct 1996.
- Biodiversity survey of Maenam WS, south Sikkim, in collaboration with the World Pheasant Association in April-May 1998.
- Red Panda pilot survey for the WWF in and around PAs, Sep-Dec 1998.
- Bird ringing studies in Fambong Lho WS, Kyongnosla Alpine Sanctuary, Himalayan Zoological Park, east Sikkim, 1992-93, 1995-96, 2000.
- Alpine Grassland Ecology Project of BNHS in sub-alpine, alpine and Trans-Himalayan areas of north Sikkim, 2000-2005, study sites being Tso Lhamo plateau, Thangu, Lhonak and Lashar valleys, Yumesamdong, Yumthang (Ganguli-Lachungpa 1996, Ganguli-Lachungpa and Rahmani 2002).
- Lhonak Valley and on the cold desert of the Tso Lhamo Plateau in North Sikkim, are home to endangered Tibetan Snowcock *Tetraogallus tibetanus* and the commoner Snow Partridge *Lerwa lerwa*.

As many as 16 species of galliformes were recorded from this small portion of the Himalayas, ranging from the Tibetan Snowcock *Tetraogallus tibetanus* on the Tibetan Plateau, to the Indian Peafowl *Pavo cristatus* and Red Junglefowl *Gallus gallus* in the sub-tropical south. So far, the DFEWL has not recorded the Rufous-throated Hill Partridge, reported in literature from 'Sikkim Terai' area, (Ali 1962, Ali and Ripley 1983), which is no longer within the present limits of the state. Some Indian Peafowl *Pavo cristatus* from Punjab were released into the lowland forests over two decades ago by the DFEWL to augment the reportedly existing population straying across from the West Bengal border. In fact, in the last few years, there have been instances of complaints of crop-raiding by the peafowl in village around the Kitam Forest. Interestingly, Grey Peacock pheasants were reported as recently as 1999 from Kewzing, South Sikkim and the recently declared Pangolakha WS in East Sikkim.

There are eight PAs in Sikkim (Table 1A), with only one (Kitam WS) for Indian peafowl in the lowland forests and none in Trans-Himalayan Sikkim, though a Cold Desert PA for trans-border ungulates such as the Tibetan Argali, Tibetan Wild Ass, and Tibetan gazelle has been proposed in the north (Table 1B).

D: Management of galliformes in Sikkim

Wildlife management practices in Sikkim are habitat specific instead of species specific. Despite the State Bird being a Galliformes, till date there has been no systematic survey or population estimation of these birds. The following management actions are being practiced in the state for the conservation of wildlife including galliformes.

1. Habitat oriented management

- Habitat improvement:** Afforestation of wildlife amenable species using gap plantation in degraded areas and block plantation in forest blanks
- Water regime improvement:** Creation of waterholes, revitalization of existing lakes and ponds
- Reducing fire hazards:** With help from the Eco Development Committees around PAs

2. Law enforcement: Implementation of Wildlife (Protection) Act (1972), creation of information network with help from Ecocodevelopment Committees (EDC), reduction of grazing, liaisoning with the Indian Army and the Border Roads Organisation

3. Research and Development: Field surveys, mapping of PAs using remote sensing & GIS (recently initiated)



Table 2 : Occurrence of Galliformes in different Protected Areas of Sikkim. Information based on departmental surveys and records

S.No	Species	Protected Areas (PAs)								Proposed PA
		KNP (N&W)	SRS (N)	KAS (E)	FBL (E)	PGL (E)	BRS (W)	MNM (S)	KWS (S)	Trans-Himalaya (N)
1	Snow Partridge <i>Lerwa lerwa</i>	+	+	+	-	+	+	-	-	+
2	Tibetan Snowcock <i>Tetraogallus tibetanus</i>	+	-	-	-	-	-	-	-	+
3	Black Francolin <i>Francolinus francolinus</i>	-	-	-	-	-	-	-	?	-
4	Tibetan Partridge <i>Perdix hodgsoniae</i>	+	-	-	-	-	-	-	-	+
5	Common Quail <i>Coturnix coturnix</i>	-	-	-	-	-	-	-	?	-
6	Common Hill Partridge <i>Arborophila torqueola</i>	+	+	+	+	+	+	+	-	-
7	Rufous-throated Hill Partridge <i>Arborophila rufogularis</i>	-	-	-	-	-	-	?	?	-
8	Red-breasted Hill Partridge <i>Arborophila mandellii</i>	-	-	-	+	-	-	+	+	-
9	Blood Pheasant <i>Ithaginis cruentus</i>	+	+	+	-	+	+	-	-	-
10	Satyr Tragopan <i>Tragopan satyra</i>	+	?	+	+	+	+	+	-	-
11	Himalayan Monal <i>Lophophorus impejanus</i>	+	+	+	-	+	+	-	-	-
12	Red Junglefowl <i>Gallus gallus</i>	-	-	-	?	?	?	?	+	-
13	Kalij Pheasant <i>Lophura leucomelanos</i>	+	-	-	+	+	+	+	+	-
14	Tibetan Eared-Pheasant <i>Crossoptilon harmani</i>	-	-	-	-	?	-	-	-	-
15	Grey Peacock Pheasant <i>Polyplectron bicalcaratum</i>	-	-	-	-	?	-	?	-	-
16	Indian Peafowl <i>Pavo cristatus</i>	-	-	-	-	-	-	-	+	-

[District name given in parenthesis (N-North, E-East, W-West, S-South). PAs: SRS = Shingba Rhododendron Sanctuary (N), KAS = Kyongnosla Alpine Sanctuary (E), FBL = Fambong Lho Wildlife Sanctuary (E), PGL = Pangolakha Wildlife Sanctuary (E), KNP = Khangchendzonga National Park (N & W), BRS = Barsey Rhododendron Sanctuary (W), MNM = Maenam Wildlife Sanctuary (S), KWS = Kitam Wildlife Sanctuary (S)]



4. Survey and demarcation: Installation of boundary pillars around PAs

The DFEWL carries out regular patrolling for monitoring of habitat to control wildlife offences inside the PAs. However there is no effective monitoring of galliformes populations outside PAs.

With newer areas under the PA network, many more management initiatives are being proposed such as intensive scientific research, strengthening of EDC network, training of forest staff, creation of alternative livelihoods for people dependent on forest resources and preparation of detailed management plans for the PAs.

Galliformes such as Himalayan monal and Satyr Tragopan are also covered under an *ex situ* management programme in the Himalayan Zoological Park at Bulbuley, Gangtok. Two more *Ex-situ* conservation facilities are underway. (Table 3).

There are however many limitations for wildlife conservation in Sikkim, the leading one being those imposed by international border restrictions (Nepal, China and Bhutan), difficult terrain and harsh, high altitudes, followed by lack of awareness, of motivation, of infrastructure and logistics, lack of skilled manpower, lack of research and lack of funds. This severely limits options for patrolling wildlife outside PAs especially in the Trans-Himalayan areas of Sikkim.

Main threats

One of the main threats being faced by wildlife (especially Galliformes) as perceived by the DFEWL is lack of awareness, especially in the remote areas. Galliformes such as Kalij, Indian Peafowl, occasionally fall prey to traps laid for crop protection. There have also been instances of discarded wire and metal being used to snare pheasants in restricted areas where road construction and

maintenance take priority and temporary settlements of non-native labourers are located. Along the international border national defence takes priority. Also, all wildlife is plagued by the problem of stray and feral dogs near army installations.

In the Tropical Ecoregion *Lantana camara*, *Mikania micrantha* are major weeds. Forest fires are generally reported from this zone and there is an occasional problem of illegal removal of the Sal, Teak trees. New hydroelectric projects have also been taken up in this zone. This ecoregion is not fully represented in the PA network, though a representative area of the Kitam Reserve Forest has been declared as a WS.

In the Sub-Tropical Ecoregion *Eupatorium* spp. is a major invasive exotic weed competing out local *Artemisia* and other secondary growth. Large Cardamom under-planted in forest patches and a tea estate at Temi are dominant features of the landscape as much as the naturalized exotic *Cryptomeria japonica* patches.

In the Trans-Himalayan ecoregion, extensive road network with constant maintenance work leaves scope for long-term damage to the fragile ecology as well as for poaching of the endangered wildlife of the region.

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Table 3 : *Ex-situ* Conservation Areas of Sikkim

Name of the Conservation Area	District	Area
1. Himalayan Zoological Park, Bulbuley	East	205 ha
2. Rabdentse Bird Park (initiated)	West	18.85 ha
3. Rangrang Butterfly Park (initiated)	North	06.50 ha



18.0 Status, Distribution and Management of Pheasants in Arunachal Pradesh

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Introduction

The Eastern Himalaya and hills of northeast India are well known for their rich biological diversity. Arunachal Pradesh represents eastern most section of the Eastern Himalaya and northern section of northeast hills. The state is part of one of the Global Biodiversity Hotspots namely Indo-Burma Biodiversity Hotspot (Myers, 1988). The State has largest geographical area among northeast Indian states due to which large populations of many species occur. It has large altitudinal range from plains (50m) to high mountains (>7,000 m) giving rise to habitats suitable for a whole spectrum of east-Himalayan and north-east Indian biological elements. Like other life forms, the state is known for avifaunal richness with more than 700 species of birds. The State forms a large part of the Eastern Himalaya Endemic Bird Area (Stattersfield *et al.* 1998). Arunachal Pradesh is largely forested state with 13 Protected Areas (PAs) covering 12.8 % geographical area of the state.

Importance of Arunachal Pradesh in Pheasant Conservation.

- The State is home to at least 10 species of pheasants. Of these, Blyth's Tragopan (*Tragopan blythii*) and Sclater's Monal (*Lophophorus sclateri*) are globally threatened (Fuller and Garson, 2000).
- Temminck's Tragopan (*Tragopan temminckii*) and possibly Tibetan Eared Pheasant (*Crossoptilon harmani*) also occur in this state. Three subspecies of pheasants (Western Sclater's monal (*Lophophorus sclateri arunachalensis*), Mishmi Blood Pheasant (*Ithaginis cruentus kuseri*) and possibly Western Blyth's Tragopan (*Tragopan blythii molesworthi*) also occur within the State.
- The state has large area under forest and many forest areas are still relatively free from biotic and other disturbances. For example, PAs such as Namdapha NP, Mouling NP and Dibang WS have large chunks of relatively undisturbed forests due to their remoteness. Many areas outside PA network especially remotely

located forested areas in the hills and mountains, hold great survival potential for large number of species including pheasants.

Species and Area wise distribution

The information available is far from adequate, and is based on few survey reports and personal observations (Kaul and Ahmed, 1992; Kaul *et al.* 1995; Singh, 1994, 1999). In most cases, we do not exactly know distributional limits. The present information on the area wise distribution of pheasant species in the state is summarized in Table 2.

Gaps in information on pheasants of the state

Species and subspecies distribution limits are inadequately known thereby making prioritization of areas for conservation difficult. Information on the occurrence and status of most of the species are scarce and that too limited to a few localities only..

- ii. Taxonomic status of many pheasant taxa remains unclear (Fuller and Garson, 2000). Taxonomic evaluation of subspecies and populations is necessary for prioritizing taxon based conservation. The state has quite a few subspecies of pheasants, and there may be many populations as well, which might be separated by geographical barriers such as rivers and mountain ridges. Possible genetic isolation among such groups may give rise to separate biological entities. For prioritizing conservation, we need to know taxonomic distinctness of these subspecies and populations. As in the case of *Lophophorus sclateri arunachalensis* (Kumar and Singh, 2004) some of these may get elevated to higher taxonomic rank once the detailed field information and genetic details become available.
- iii. There has been no ecological studies on the pheasants in the state. As per Conservation Action Plan (Fuller and Garson, 2000), ecological research with



conservation objectives should be designed to provide new information that relates directly to aspects such as habitat requirements, tolerance to disturbances, and use of secondary or degraded habitats by a threatened species. The basic ecological requirements of the species occurring in the state has not yet been studied. This information will be crucial, if plans to restore habitats for species recovery have to be carried out in the future. Such studies are needed urgently especially for the species occurring in the lower areas because foothill forests are under greater threat.

Conservation of Pheasants

(i) **Pheasant conservation and conservation of biodiversity:** Pheasants are in general quite sensitive to habitat disturbances, and therefore can be good indicators of habitat health. If there is habitat degradation and poaching threat to an area, pheasants are among the first species to be affected. Therefore, conservation of pheasants is nothing but biodiversity conservation of the state.

(ii) **PA network and Pheasant conservation:** Arunachal Pradesh has 9,897 km² area under PA network which forms about 12.8% of total geographical area. The details of the PAs in the state are given in Table 1. The size of PAs varies from about 55 km² (Kane WS) to

4,149 km² (Dibang Valley WS). The altitude range covered by PAs is also quite high from about sea level (50 m, D'Ering Memorial WS) to more than 5,000 m (Dibang Valley WS). But the present PA coverage may not be sufficient for long-term survival of the pheasants (Kumar & Singh, 1999). Some of the conspicuous inadequacies in coverage are given below.

- (a) No PA in the state has presence of recently described pheasant taxon *Lophophorus sclateri arunachalensis*.
- (b) Except for a few large PAs (e.g. Dibang Valley WS, Namdapha NP & Pakke WS) other PAs are small in area, and consequently cover only a very small portion of distributional range of the pheasants. The location of the PAs is also not uniform from east to west and north to south. For example we do not have any PA in the high altitudes of the north-west. In a state such as Arunachal Pradesh where large rivers provide dispersal barriers to fauna, there are likely to be distinct populations across the barriers, and therefore any meaningful conservation strategy has to take into consideration conservation of this variability. This can be achieved if conservation efforts go beyond PA boundaries.

The list of PAs, with their geographical area, altitudinal extent and potential pheasants species in them is given

Table 1: Protected Areas of Arunachal Pradesh

S.No.	Name of PA	Year of Estb.	Area(km ²)	Altitudinal Range* (m)	District Location
1.	Mouling NP	1986	483.00	750-3064	Upper Siang
2.	Namdapha NP	1983	1807.82	200-4578	Changlang
3.	D'Ering Memorial WLS	1978	190.00	50 -150	Upper Siang
4.	Dibang WLS	1991	4149.00	2000-5356	Dibang Valley
5.	Eagle Nest WLS	1989	217.00	600-3200	West Kameng
6.	Itanagar WLS	1978	140.30	250-460	Papum Pare
7.	Kamlang WLS	1989	783.00	??	Lohit
8.	Kane WLS	1991	55.00	120-1500	West Siang
9.	Mehao WLS	1980	281.50	400-3560	Dibang Valley
10.	Pakhui WLS	1977	861.95	100-2000	East Kameng
11.	Sessa Orchid WLS	1989	100.00	500-2500	West Kameng
12.	Tale Valley WLS	1995	337.00	120-3000	Lower Subansiri
13.	Yardi-Rabe Supse WLS	1996	491.62	c. 1500-2500	West Siang
Total area			9897.19		

* source - Islam and Rahmani, 2004



at Appendix A. Birdlife International has taken initiative to prioritize network of high conservation value bird areas under its Important Bird Area Programme (IBA) (Islam and Rahmani, 2004). Many of the IBAs are PAs and some of them are Reserved Forests. The list of IBAs with pheasant species known to occur in them is given in Table 2.

The limitation of IBA approach is that the IBAs themselves do not have legal status. Therefore protection of such IBAs which are not PAs or Reserved Forests is quite challenging.

- (v) **Involving People in Conservation:** Conservation can not succeed without local people's support. This is especially true in the tribal areas where traditional dependence on forests has been high. In Arunachal Pradesh where large tracts of wilderness areas are outside PAs and legally protected forest categories, enlisting local support is *sine non-qua*. People's support will only be forthcoming if people see forests as source of sustained income to them. One of the activities that can generate substantial revenue without causing damage to the ecology of the area is eco-tourism. The state has very high potential for natural area based tourism, and if suitably planned eco-tourism can become major source of state revenue and local people's income. Neighbouring country Bhutan is an example for guiding tourism in the state. Recent initiatives in Eagle's Nest WS by Kaati Trust and the same model can be initiated in other parts of the State.

6. Survey and Monitoring of Pheasants

Surveys are the first steps towards understanding both a species' requirements and potential threats to its survival. Conservation action cannot be properly planned without such basic knowledge (Fuller and Garson, 2000). Surveys are all the more important where baseline information on the occurrence and status of pheasants from many areas in the state is lacking. Therefore, it is important to carry out systematic survey out for all pheasants.

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Table 2 : Important Bird Areas and Pheasants in Arunachal Pradesh

PA's	Important Bird Area (IBA)	Pheasant Species
1.	Chaglagam-Denning-Walong	Himalayan Monal
2.	Chayang Tajo - Khenewa - Bameng	Temminck's Tragopan, Kalij, Grey Peacock, Sclater's Monal
3.	Déring Memorial WS	Red Junglefowl
4.	Dibang Reserve Forest and adjacent areas	Not known
5.	Dibang WS	Blyth's Tragopan, Himalayan Monal, Sclater's Monal,
6.	Ditchu Reserve Forest	Blood Pheasant, Grey Peacock Pheasant, Himalayan Monal, Kalij , Tibetan-eared Pheasant,
7.	Eagle Nest WS and Sessa WS	Blyth's Tragopan, Satyr Tragopan, Grey Peacock Pheasant
8.	Itanagar WS	Red Junglefowl, Kalij, Peacock Pheasant
9.	Kane WS	Red Junglefowl, Kalij, Peacock Pheasant
10.	Koloriang - Sarli - Damin	Blood Pheasant, Sclater's Monal, Kalij , Temminck's Tragopan
11.	Magu Thingbu	Satyr Tragopan, Sclater's Monal
12.	Manabum and Tengapani Reserve Forests	Red Junglefowl, Kalij, Peacock Pheasant
13.	Mechuka-Monigong-Jorgging	Blyth's Tragopan, Sclater's Monal
14.	Mehao WS	Blyth's Tragopan
15.	Mouling NP	Blyth's Tragopan
16.	Nacho - Limeking - Taksing-Majha	Sclater's Monal
17.	Nafra - Lada Area	Blyth's Tragopan, Sclater's Monal
18.	Namdapha-Kamlang	Grey Peacock Pheasant, Blyth's Tragopan, Mrs Hume's Pheasant, Red Junglefowl
19.	Namsangmukh-Borduria	Red Junglefowl, Kalij, Peacock Pheasant
20.	Pakhui or Pakke WS	Grey Peacock Pheasant, Kalij, Red Junglefowl
21.	Papum Reserved Forest	Red Junglefowl, Kalij, Peacock Pheasant ?d
22.	Sangti Valley	Blyth's Tragopan, Temmick's Tragopan
23.	Shergaon, Mandla-Pudhung, Kalaktang	Blyth's Tragopan, Satyr Tragopan
24.	Talley Valley WS	Blyth's Tragopan?, Temmick's Tragopan?
25.	The Chapories of Lohit Reserve	Red Junglefowl, Kalij
26.	Thungri-Chaglang-Poshingla Complex	Blyth's Tragopan, Satyr Tragopan, Temmick's Tragopan, Sclater's Monal
27.	Yardi-Rabe Supse WS	Red Junglefowl, Kalij ??
28.	Zemithang-Nelya	Satyr Tragopan

[illegible]





19.0 Status, Distribution and Management of Galliformes in Assam, Meghalaya and Tripura

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Introduction

The states of Assam, Meghalaya and Tripura in northeast India are part of a global biodiversity hotspot (Myers *et al.* 2000). These states have high habitat diversity and also high galliformes diversity with 19 species out of a total of 45 species recorded in India. This includes 13 partridges and six pheasants. Five of these are threatened while three are range-restricted. Although their general range has remained almost the same, the expansion of human habitation, the destruction of habitats by agriculture (slash-and-burn shifting cultivation, known as *jhum*) and logging and hunting have resulted in a sharp decline in abundance as well as causing fragmentation. Although many Galliformes occur within Protected Areas (PA), the enforcement of wildlife laws is inadequate at many places.

Historical information on the Galliformes of these states can be found in some synoptic works such as Ali (1949); Baker (1921-30, 1922-30); Hume (1888); Hume and Marshall (1880); Oates and Blanford (1889-98); and Stevens (1923-25). Noteworthy data are also found in Ali and Ripley (1987); Grimmet *et al.* (1998) and Kazmierczak and Van Perlo (2000). All the threatened species have been treated in great detail by BirdLife International (2001). Brief status reports are also found in Fuller *et al.* (2000); Fuller and Garson (2000); McGowan *et al.* (1995) and McGowan and Garson (1995).

Regionally, recent information on the Galliformes of Assam is found in Choudhury (1996, 2000, 2005). Ghose *et al.* (2002) also provide a brief status report of the Galliformes of the region. Habitat loss and fragmentation due to felling of trees, slash-and-burn shifting cultivation, encroachment, and poaching for the pot have threatened most of the Galliformes. For the conservation of Galliformes, developing a long-term strategy in the

northeast region of India is of high importance. This has become a high priority due to the rapid loss of habitat, increased hunting and fragmentation resulting in small isolated, potentially unviable, populations. Therefore there is an urgent need for a comprehensive review of the distribution and current status of Galliformes in northeast India.

States of Assam, Meghalaya and Tripura contain a major plain in the form of the Brahmaputra valley in Assam. There is significant habitat diversity in the region resulting from the large altitudinal ranges (50m to over 2,000m). The main forest types are tropical wet evergreen rainforest, tropical semi-evergreen forest, tropical moist deciduous forest, subtropical broadleaf and coniferous forest, wet savanna grassland and swamp forest. The annual rainfall ranges from less than 1,000 mm in parts of central Assam to more than 10,000 mm in parts of the southern face of the Meghalaya plateau (up to above 24,000 mm recorded in Meghalaya). About 75% of the rainfall is received during the monsoon (May to September). Winter rains are not uncommon. Since 1985, field studies have been carried out in different parts of north east India to determine the distribution and status of different species of wildlife including Galliformes. This review is based upon the results of these field surveys and is supplemented by information from other published studies.

Distribution and status of galliformes

Black francolin *Francolinus francolinus*

Widely, but thinly distributed in the plains and foothill areas of Assam and Meghalaya (Ali and Ripley 1987, Choudhury 2005). There are fewer recent records. Among the PAs,



recent records are only from Dibru-saikhowa (K.Lahkar and M.Phukan, *in litt.*), Orang National Park (NP) (Choudhury, *in litt.*, and Lahkar and Phukan 1995) and Manas NP and Chakrashila Wildlife Sanctuary (WS) of Assam (Lahkar 2003a). In Manas NP, however, it is commonly heard at a few sites.

Swamp francolin *Francolinus gularis*

Widely but patchily distributed throughout the Brahmaputra valley in Assam. There are also historical records from Meghalaya (Ali and Ripley 1968–1998, BirdLife International 2001, Choudhury 2005). It occurs in the wet savanna grassland in the floodplains and also in the terai belt along the foothills, from less than 50m to 150m elevation (except for a past record from ca. 1,400m near Cherrapunjee, undated (Godwin-Austen 1870). Although recorded from all the districts in the plains of Assam, its current distribution is highly fragmented. Overall, the species is still found in at least 30 localities (11 are PAs) of Assam. There are large populations in some PAs such as Dibru-Saikhowa NP, Kaziranga NP, Manas NP and Orang NP, and in Burhachapori WS, Laokhowa WS, Pabitora WS and Pani-Dihing WS (Choudhury 2000, Bhagabati and Lahkar 1998, Lahkar 2003b). Also found in Kochmora Reserved Forest (RF) (Sonitpur dist), Bordoibam-Bilmukh WS and Sonai-Rupai WS. There is no recent sighting in Nameri NP. In the lower Assam districts, very few birds occur outside PAs, but in upper Assam, scattered populations are still found in Lakhimpur (Pabho RF, Borchapori area, Khabolu area and many localities of Dhakuakhana subdivision), Dhemaji (Jamjing and Sengajan RFs, Kobo *chapori*, Bordoloni area and the *chapories* of the Brahmaputra River), Jorhat (Majuli area), Dibrugarh (Dihingmukh RF) and Tinsukia (Amarpur and other areas of Sadiya) districts. Its continued survival in Barak valley districts is doubtful (Choudhury 1997). There are no recent reports from Meghalaya. Total potential habitat available in Assam is ca. 1,200 km². A rough assessment based upon densities extrapolated on the basis of calls, suggests that there may be 7,800 – 11,800 birds in Assam (Choudhury, 2000). However, there is a noticeable decline in Manas NP, Pabitora WS, Bordoibam and outside the PAs although a quantitative assessment needs to be undertaken.

The main strongholds now are Kaziranga NP and Orang NP. The declines in Bordoibam-Bilmukh and Pabitora WS since 1998 are due to destruction of tall grassland by villagers and prolonged flooding, followed by heavy grazing. Elsewhere outside the PAs the general decline has been due to agricultural expansion. The world population was estimated at 1,000 - 10,000 individuals (McGowan *et al.* 1995), however, this may be an underestimate as the population in Assam alone is estimated to be greater. About 65% of the potential habitat available in Assam is protected.

Quails *Coturnix* spp.

Very little information is available on all the quails, due to the difficulty in field identification unless closely observed or in the hand. Common Quail *Coturnix coturnix* has been recorded in western Assam as wintering and as a passage migrant. Japanese Quail *Coturnix japonica* is a winter visitor and has been recorded in Assam only (Choudhury 2000). There is also a specimen from Dibrugarh in eastern Assam at the Bombay Natural History Society (Abdulali 1970). Rain Quail *Coturnix coromandelica* has been recorded in Assam. It is mainly a resident. Blue-breasted Quail *Coturnix chinensis* is recorded in Assam as resident (Choudhury 2000, Johnsgard 1988). There are recent records from Kaziranga NP and Manas NP and Chakrashila WSI in Assam.

Jungle Bush Quail *Perdicula asiatica*

Its known range is well outside the limits of northeast India. However, a record from Chakrashila WS in western Assam (Barua 1995), indicated that it occurs in northern West Bengal. Status of this species in Assam is not known.

Manipur Bush Quail *Perdicula manipurensis*

A poorly known species, this bird was rediscovered after a gap of more than 75 years in Manas NP (Choudhury 2006a,b). A bird was flushed twice from grass on the motorable track between Gabhorokunda River and Chidajhar (Garwa) *Nullah* (ca. 26° 46' N, 90° 51' E) in Panbari Wildlife Range on 6 June 2006. The known historic site of this bird at Mornoi Tea Estate, Kokrajhar district (originally recorded as Goalpara), from where 14 specimens were obtained in 1905-07 (BirdLife International 2001) is located at the south-western edge of the buffer zone of Manas Tiger Reserve. All the grasslands in and around Mornoi have vanished long back, in 1950s. The last confirmed record of this species in its entire range was "pre-1932" in unspecified localities of Manipur Valley (Higgins 1933-1934 in Choudhury 2005).

Its known range extended from northern West Bengal to Assam and Manipur (Ripley 1982). Although Meghalaya and Nagaland were also included within its range (Baker 1922–1930) but there is no firm evidence. The confirmed localities were in northern West Bengal, Assam and Manipur. Status is difficult to assess as observing the species is difficult due to dense habitat it occupies and the skulking nature of the birds. All the past records result from killed or captured birds and hence, it is possible that it is under-recorded during field surveys.

Common Hill Partridge *Arborophila torqueola*

It occurs in the higher areas of Barail Range of Assam (Ali and Ripley 1987, Choudhury 2005), in the forested hills and mountains. Overall, the species is rare, mainly due to lack of high elevation habitat.

**Rufous-throated Hill Partridge** *Arborophila rufogularis*

It is widely distributed in the forested foothills, hills and mountains, from ca. 600 m up (Choudhury 2005). It is still common in many places and so far, it has been recorded in at least 30 PAs of northeast India.

White-cheeked Hill Partridge *Arborophila atrogularis*

It is widely distributed to the south of the Brahmaputra River in Assam, Meghalaya and Tripura (Ali and Ripley 1987, Grimmett *et al.* 1998). It occurs in forests in the plains and hills, from < 50 m to > 1,500 m, however, it is relatively more abundant in the foothills and the edges of the plains. So far there are confirmed records from more than 11 PAs of these states (Choudhury 2000, Lahkar 2001).

Chestnut-breasted Partridge *Arborophila mandellii*

Rather poorly known, this bird is known marginally from Assam (BirdLife International 2001). The available data is very limited to make a proper assessment of habitat requirements, abundance and distribution, but is known to occur in hill and mountain forests between 350 m up. In Assam, there are historical records from Bhutan Duars, which are likely to be the part of the Bhutan Duars currently in West Bengal (BirdLife International 2001). However, it should be noted that more than half of the 'Bhutan Duars' is in Assam extending from Kokrajhar to Darrang district covering part of six districts, while in West Bengal only one district (Jalpaiguri). There are only two recent records, Subansiri RF, Dhemaji district (Choudhury 2000) and Nameri NP, both in the 1990s (P.K.Saikia, *in litt.* in Choudhury, 2000; this latter record may need confirmation).

Mountain Bamboo Partridge *Bambusicola fytchii*

It is widely distributed throughout the forested and degraded hills, including the foothills, south of the Brahmaputra River. It is recorded from the edge of the plains up to 1,900 m in the Barail range, Assam, but it is more frequent below 1,500 m. It has been recorded in at least 10 districts of Assam, Meghalaya and Tripura. It occurs in the grassy hillsides, abandoned *jhums* and mixed forest with bamboo. Overall, the species is still found in more than 10 PAs of these states (Lahkar 2001, Lahkar 2002).

Blyth's Tragopan *Tragopan blythii*

Occurs mainly in subtropical and temperate broadleaf forests in a small area of Assam (BirdLife International 2001, Choudhury 2000). In the Barail Range, it occurs from 1,800 m up. In the case of Henema (Jerdon 1870), the birds were either from Mt Paona or from Laike area of Assam. In Assam, it has been recorded from eastern areas of Barail Range in North Cachar Hills district (Choudhury 2000). The historical records from the area include, pre-1904 (male in BMNH), this presumably also being the site for two birds in April, pre-1899, nine more collected, March,

c. 1898 (Baker 1894–1901), and eggs taken in April 1899 (BMNH egg data), with sightings apparently around Mahadeo, Hengmai and Hungrum (Beebe 1918–1922, Johnsgard 1999). The current status in the area is unknown as for about a decade or so, it is a highly disturbed area. However, a small population still occurs as one was shot by a hunter from Nagaland near Laike in Assam in 2001.

Kalij Pheasant *Lophura leucomelanos*

The subspecies *lathamii* (Black-breasted Kalij) is found in the region with a single record of *moffitii*. A popular game bird that is much sought after by hunters, it is resident and still very common in places. It is more abundant in the south bank areas of the Brahmaputra River where it occurs at ca. 30 m in Karimganj district of Assam to above 1,900 m in the Barail range. Sightings are frequently in the mornings and evenings. It occupies forested foothills, hills, and the edges of the plains including cultivation near forests. So far it has been recorded in at least 30 PAs and numerous RFs across these states (Choudhury 1998, 2000, Lahkar 2001, 2002).

Red Junglefowl *Gallus gallus*

A very common species, also popular as game bird and much sought after by hunters. Found all over in the forested foothills, hills, and plains. It occurs from ca. 30 m in Tripura and Karimganj district of Assam to different elevations range of altitudes depending on area, but mostly below 1,000 m (rarely up to 2,000 m). Also occupies edges of cultivation near forest, scrub jungle, and wooded tea gardens. It is mostly seen in small groups often in mixed flocks with Kalij Pheasant. It has been recorded in at least 30 PAs and numerous RFs across these states.

Grey Peacock-pheasant *Polyplectron bicalcaratum*

A common and widespread resident, it occurs from ca. 30m elevation in Karimganj district of Assam to ca. 1,200m in the hills and mountains. Sightings are rare as the birds are more often heard rather than seen. It has been recorded in more than 18 PAs and numerous RFs across these states (Choudhury 2000, Lahkar 2001, 2002). This species is very sought after by hunters. It occurs in evergreen as well as deciduous (with evergreen undergrowth) forests. Mostly seen in single or pairs. It is usually not seen at the edges of cultivation near forest and wooded tea gardens.

Indian Peafowl *Pavo cristatus*

Although an uncommon resident in the region, it is a very well known bird. Assam is its easternmost limit of distribution. It has disappeared from many parts of its former range and now occurs mainly in western Assam. It has already become extinct in Meghalaya where it was not uncommon in Garo Hills. In Assam, the range is restricted to the *Duars*, from Kokrajhar to Darrang districts through the northern parts of Bongaigaon, Barpeta, Nalbari and Kamrup



districts (in the reorganised districts of Kokrajhar, Chirang, Baksa and Udalguri). PAs where the species is found are Manas NP and Barnadi WS. Outside PAs, it has become scarce and sightings are not frequent. The easternmost limit of distribution is Rowta RF (92°21'E), which is also now its easternmost world distribution (Choudhury 2000). Unlike northern India, they are not found in the countryside or in semi-feral state in the region. They are also not considered sacred in Assam and other parts of northeast India and are hunted for food.

Green Peafowl *Pavo muticus*

The subspecies *spicifer* occurs in India between 50m and 1,000m elevation (Ali and Ripley 1987). It is a very scarce resident with no recent report from these states. In Assam, it was formerly widespread to the south of the Brahmaputra River, from Nagaon to Cachar district. However, there has been no recent reports. The last reports were of a few stragglers from Barak RF (Bhuban Hills) of Cachar district in the 1970s (Choudhury 2000). One reportedly shot by a hunter in Jiriking area of Karbi Anglong in the early 1970s (Choudhury 1993). In the nearby Habang (Umwang) area, a few stragglers were reported whose species could not be ascertained, however, it is very likely to be of this species based on geographical location. The species has become locally extinct in most of its range in India mainly due to hunting for food. There was a peafowl kept at Imphal zoo in Manipur, which was reportedly obtained from Cachar district of Assam but no locality details was available.

Threats to Galliformes

Habitat loss

Habitat destruction has threatened the survival of the Galliformes all over their range in these states. Unplanned clearance has resulted in habitat fragmentation in places resulting in isolated populations, which have an uncertain future. Forests are destroyed primarily by logging, expansion of agriculture, slash-and-burn shifting cultivation by hill tribes, unplanned clearance for human settlement, encroachment by developmental activities, road and railway construction, large-scale and unplanned bamboo harvesting for paper production and oil and coal mining. The rate of forest clearance in Meghalaya has reduced dense forest cover from 33.1% to 18.0% respectively (NRSA 1983, FSI, 1997). Grasslands are subject to intense pressures from encroachment for settlements and cultivation, over-grazing by domestic livestock, grass harvesting, fire and tree plantation.

Poaching

Galliformes are hunted predominantly to provide meat, mostly for local consumption. Even in some PAs such as Gumti WS in Tripura and Pani-Dihing WS in Assam galliformes are

poached. Snaring is commonly used, as the hunter need not pursue the birds, but only set the snares in suitable habitats.

Insurgency

This is a rather new but serious problem affecting galliformes and other wildlife in different parts of northeast India. Since late 1980s, insurgency has spread almost all over affecting many of the well known PAs such as Manas NP, Balpakram Tiger Reserve, Gumti WS and Sonai-Rupai WS. In the main, the extremists themselves do not hunt wildlife, but unscrupulous elements are taking advantage of the situation to undertake illegal hunting and logging.

Conservation Measures Undertaken

Legal protection

The majority of galliformes are protected under Schedule I of the Wildlife (Protection) Act 1972, of India, which prohibits their killing or capture.

Habitat protection

Several PAs have been created to protect the galliformes in these states. Galliformes occur within all the 33 NPs and WSs in these states. The degree of protection this provides to different species is highly variable. For example, for the swamp francolin in Assam, more than 65% of its range is within the PA system, whereas for Blyth's tragopan, it is 0%. Except for some PAs, such as Kaziranga NP and Orang NP in Assam, the enforcement of protection measures are inadequate.

Recommendations

Status survey, population estimate and monitoring

Surveys to collect comprehensive information on the distribution of galliformes, especially the ones classified as endangered should be undertaken. The Manipur Bush Quail is a priority species. These estimates need to be produced at regular intervals.

Creation of more PAs

The creation of more PAs is strongly recommended. Some high priority areas are: Assam (Kobo *chapor*i, Barail area near Laike-Hemplopel) and Meghalaya (Narpuh). Extension of existing PAs such as Balpakram Tiger Reserve – Siju WS and Nongkhylliem WS in Meghalaya, and Barnadi WS in Assam, is also required. The people's initiative shown by the villagers of Ghosu and Khonoma need to be replicated by other northeastern states where bulk of the land belongs to the community. Some high priority areas for Community Reserves are: Meghalaya (sacred forests near Cherrapunjee and Mawphlang) and in Tripura (near Jampui tlang).



Control of Poaching

The enforcement of Wildlife Laws to stop the hunting of Galliformes needs to be increased. Anti-poaching staff need to be well trained, better equipped and motivated.

Control of habitat destruction

While it is not possible to completely stop *jhum* cultivation because it is a way of life and deeply imbedded in culture, some sustainable economic alternatives should be taken to control it, especially near the prime habitats. No new encroachments should be allowed to take place at least in the RFs. Fresh encroachments, especially those inside the important galliform habitats should be prevented. Considering the reduced forest cover remaining, particularly outside the PAs, logging in the remaining natural forests should be prevented, or at the least severely controlled.

Effective protection and management of the existing PAs

All PAs should have effective law enforcement and wildlife protection measures enhanced through well equipped, well paid, trained and motivated manpower. Communication system should be improved in all the important reserves (many such as Kaziranga NP, Manas NP, already have a wireless system).

Other measures

The following measures should be undertaken:

- Conservation education among locals, including the hill tribes of remote areas with active involvement of local NGOs.
- Reduce dependency of fringe villagers on forest. One method is large-scale installation of bio-gas (Deenbandhu model), which will greatly reduce pressure on fuel wood.
- Further research on galliformes ecology, behaviour and altitudinal movements in different habitats.
- Where grassland burning is necessary it should be carried out in January or early February.
- As one of the most important issues affecting the whole of India, it is important to undertake measures that limit the massive human population growth occurring throughout the country, especially, in the fringe areas. Although this is a national problem and is virtually an impossible task, it is ultimately the root cause of habitat destruction and needs to be taking into account when considering conservation planning.

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20.0 Status, Distribution and Management of Galliformes in Manipur, Nagaland and Mizoram

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Introduction

Northeast India is currently part of two Biodiversity Hotspots (Mittermeier *et al.* 2004) – such as Himalaya and Indo Burma hotspots. Nagaland, Manipur, Mizoram and Tripura constitute part of Indo-Burma hotspot. The Brahmaputra Valley and Assam Hills comprising a significant part of northeastern India falls under the Palaeotropical: Indo-Malayan biogeographic zones while parts of the Eastern Himalaya, constituting the rest of northeast India falls under the Sino-Himalayan sub-zone of the Borreal biogeographic zone (Rodgers and Panwar

1988). Out of the total of 44 Galliformes species occurring in India (Ripley 1982, Ali and Ripley 1983, Grimmer *et al.* 1998), 31 species are reported from northeast India (Choudhury 2005a) and 16 species are found in the three states of Manipur, Nagaland and Mizoram (Fig. 1). There are six species of partridges, four species of quails and six species of pheasants that are present in these three states (Table 1). Out of these five species are threatened as per the latest IUCN-WPA Pheasant Action Plan (Fuller and Garson 2000).

Table 1 : Galliformes of Manipur, Nagaland and Mizoram

Common Name	Scientific Name	Threat Status
Black Francolin	<i>Francolinus francolinus</i>	
Chinese Francolin	<i>Francolinus pintadaenus</i>	
Japanese Quail	<i>Coturnix japonica</i>	
Rain Quail	<i>Coturnix coromandelica</i>	
Blue-breasted Quail	<i>Coturnix chinensis</i>	
Manipur bush Quail	<i>Perdicula manipurensis</i>	Vulnerable
Hill Partridge	<i>Arborophila torqueola</i>	
Roufous-throated Partridge	<i>Arborophila rufogularis</i>	
White-cheeked Partridge	<i>Arborophila atrogularis</i>	Near Threatened
Mountain Bamboo Partridge	<i>Bambusicola fytchii</i>	
Blyth's Tragopan	<i>Tragopan blythii</i>	Vulnerable
Kalij Pheasant	<i>Lophura leucomelanos</i>	
Red Junglefowl	<i>Gallus gallus</i>	
Mrs. Hume's Pheasant	<i>Syrmaticus humiae</i>	Vulnerable
Grey Peacock Pheasant	<i>Polyplectron bicalcaratum</i>	
Green Peafowl	<i>Pavo muticus</i>	Vulnerable



Information on the distribution of galliformes in the three states is scanty except for some larger species such as Blyth's Tragopan and Mrs. Hume's Pheasant (Choudhury 1996, 2002). This paper makes efforts to collate all available information collected during the past two decades and compare this with the historical distribution of the species obtained by examining the old records and also visit them on the perspective of the current conservation scenario.

Past scenario of important galliformes species in Manipur-Nagaland-Mizoram

Manipur Bush Quail - Once resident in the states of Assam and Manipur, this bird occurred in the Cachar, Khasi and Naga hills and also south of the Brahmaputra river (Hume 1888, Powell Connor 1908, Baker 1921-1930, Higgins 1933-34, Abdulali 1968-1996 and Ali and Ripley 1983).

White-cheeked Partridge - Ali and Ripley (1983) reported this bird from Assam, Khasi hills in Meghalaya, Naga hills in Nagaland, Manipur, Mizoram and in Tripura. The past distribution of this bird is also based on the observations of Baker (1921-1930) and Ali and Ripley (1983).

Blyth's Tragopan - Jerdon 1870, Godwin-Austen 1874, Cran 1887, Turner 1899, Beebe 1910, Baker 1921-1930, Higgins 1933-1934, Ripley 1952, Ali and Ripley 1983 and Abdulali 1968-1996 recorded this species from the hills south of Brahmaputra river, in Assam, Arunachal Pradesh, Nagaland, Manipur and Mizoram.

Mrs. Hume's Pheasant - Godwin-Austen 1882, Finn 1898, Baker 1921-1930, Higgins 1933-1934, Koelz 1954, Ripley 1952 and Ali and Ripley 1983 recorded this bird as rare and with a patchy distribution in the states of Manipur, Nagaland and Mizoram.

Green Peafowl - Baker 1922-1930, Higgins 1933-1934 and Ali and Ripley 1983 reported this bird to be distributed in the North Cachar hills in Assam, in Manipur and Mizoram, however, thought this species to be rare.

Present scenario of Galliformes species in Manipur-Nagaland-Mizoram

The Chinese Francolin occurs only in Manipur where it was known from south-eastern areas (Ali & Ripley, 1983, Choudhury 2005a). In 2000/01, some birds were captured by villagers from Churachandpur district in south Manipur (Samir Khan, *pers. comm.*).

Manipur Bush Quail is currently endemic to West Bengal and the northeastern states of Assam, Nagaland, Manipur and Meghalaya (Fuller and Garson 2000). However, this

species' current distribution within the limits of northeast India is very sketchy. Higgins (1933-34) recorded the decline of this species in Manipur as early as during 1930s. In recent years, only one authentic report of its occurrence has been made from the Manas Tiger Reserve, Assam (Choudhury 2006b). Extensive field surveys conducted in Manipur failed to sight this bird (Kaul *et al.* 2001). Despite the failure to see the bird, evidences in the form of feathers and reports were obtained from these parts of northeastern India, which suggest that the Manipur Bush Quail is still present there (Kaul *et al.* 2001). Habitat of Manipur Bush Quail appears to have shrunk as no recent record from Nagaland could be obtained. Detailed survey for this species in Assam, Arunachal Pradesh and Manipur is urgently required. The latest survey (Kaul *et al.* 2001) was conducted in pre-winter when it was the locals who insisted to look for the bird during the post winter or summer months when this quail comes out to the opening for feeding.

Mountain Bamboo Partridge was sighted at several places in Nagaland (Khonoma, Satoi, Thanamir, Noklak), Manipur (Jessami and a few other sites), and Mizoram (Blue Mountain NP and Murlen NP, Lengteng WS along with many other sites in Champhai district) during past one decade.

Presently, no particular survey for White-cheeked Partridge and Rufous-throated Partridge has been conducted to assess the status of these birds in the three states. White-cheeked Partridge has been reported from most of its past distribution sites. It has been recorded in northern parts of Mizoram (Choudhury 2006a). Sightings of Rufous-throated Partridge have been recorded at Khonoma, Nagaland.

Recent surveys recorded Blyth's Tragopan from Blue Mountain NP in Mizoram (Kaul *et al.* 1996, Ghose 1997 and Ghose and Sumner 1997); Satoi in Zunheboto district; entire Barail hill range, Mt. Japfu and Dzukou Valley of Kohima district; Fakim WS, Noklak and Mt. Saramati of Tuensang district; Pfutsero in Phek district – all in Nagaland (Choudhury 2001). This species is the State Bird of Nagaland. In 2000, on a trekking expedition to the Dzukou valley on the Manipur-Nagaland border, a team in which the third author was a member found a pair of Blyth's tragopan killed by a local hunter. In Manipur, it has been recorded in Siroi while the only habitat in Mizoram is in Blue Mountain (Phawngpui) as at similar heights in Murlen and Lengteng, no evidence could be found (Choudhury 2006a).

Mrs. Hume's Pheasant was recently confirmed based on evidences at the Murlen NP (Kaul *et al.* 1996) and sighted at the Blue Mountain NP (Ghose 1997, 2000) in Mizoram. This is the State Bird of Mizoram. Choudhury (2001) recorded



this bird from north of Siroi Hills and another area south of Churachandpur in the state of Manipur. Choudhury (1997, 2001) in concurrent surveys also recorded this bird from three areas in Nagaland, *i.e.*, from Phek, west of Mount Saramati and from a forested tract in Tuensang. According to the locals of Siroi village, Ukhrul district, Manipur, there could be a small population of Mrs. Hume's Pheasant in the Siroi-Kashong hill range, and the last sighting was around 1984. This is also the State Bird of Manipur and is called *Nongyin* in Siroi hills area. A subsequent survey of Hume's Pheasant could locate it in many new sites in Nagaland, Manipur and Mizoram (Choudhury 2002, 2005b).

During recent surveys, only secondary evidence of Green Peafowl was obtained from an area near Moreh at the Indo-Myanmar border in Manipur (Choudhury 2001 and Samir Khan *pers. comm.*). This species is also reported from the Khonkhan Thana village area in Ukhrul district along the Indo-Myanmar border. Surveys in Mizoram did not evoke any evidence of this bird (Choudhury 2000), but a recent report (2007) has confirmed the presence of this species in Chintupui and Lunglei districts (M.Fernandes, *pers. comm.*).

Peacock Pheasants are sighted in the Damdei village area in Parbung subdivision of Churachandpur district, Manipur. In the last visit to the area, there were evidence of a large number of the pheasant (and hornbills) recently killed by local hunters for its meat, however, the habitat was found to be in good condition, with primary forest cover over a large area. Interestingly, these pheasants reportedly used several rock shelters found in the area. This species was also found in Murlen NP and Dampa Tiger Reserve in Mizoram (Kaul *et al.* 1996). Elsewhere in Mizoram, Choudhury (2006a) found it in Inner Line RFs, Ngengpui WS, Lengteng WS, Rawlbuk and Lamzawl.

The two species common in all the low and middle altitude forests in the three states are Kalij Pheasant and Red Junglefowl. However, both face some threat in terms of hunting. A Kalij Pheasant was recovered dead from a local hunter at Tarao Laimanai village (440m; Tegnoupal subdivision, Chandel district, Manipur) in December 2003. Red Junglefowl are noticed in good numbers along the Tegnoupal-New Somtal highway, Chandel district, Manipur. Habitat in the area is primary forest mixed with secondary forests. Junglefowl are also noticed along the Sita Lamkhai-Phungyar state highway, Chandel and Ukhrul districts, and along the Singhat-Behiang highway, Churachandpur district, both in Manipur. There is some good forest cover in the Behiang area, south of the Manipur-Myanmar border, which according to local villagers has good population of wildlife.

Protected Area Coverage of Galliformes habitats in Manipur-Nagaland-Mizoram

Galliformes are also found outside of PAs in Manipur. Grey Peacock Pheasants were observed in Parbung/ Tipaimukh subdivisions of Churachandpur district which are not covered under any PA. Similarly, the reported Green Peafowl habitat in the Khonkhan Thana village area in Ukhrul district along the Manipur-Myanmar border, Red Junglefowl habitat along the Tegnoupal-New Somtal highway in Chandel district and Kalij Pheasant habitat in the Tarao Laimanai village area under Tegnoupal subdivision of Chandel district are not covered in any PA network.

Forests outside the PAs in Mizoram also hold substantial populations of Hill Partridge, Mountain Bamboo Partridge, Kalij Pheasant and Red Junglefowl.

In Nagaland, bulk of the galliformes habitat is outside the PAs. Creation of Community Reserves by several Village Councils has helped conservation to a great extent (Thomas Kent, Tsile Sakhire, *pers. comm.*).

Conservation issues of Galliformes in Manipur-Nagaland-Mizoram

Threats to the galliformes species in these three states could be depicted as follows:

- Habitat fragmentation and degradation, through a continuing decrease in the rotation period of traditional slash and burn agriculture in forested habitats,
- Reclamation of forested areas for development works such as road and dam building, expansion of human settlements,
- Anthropoid interference such as logging, lopping, forest produce collection etc.
- In Manipur, Nagaland and Mizoram where hunting is a traditional way of life in the hills, the major threat to galliformes is random hunting for meat and game.

Lack of species specific efforts targeted for galliformes conservation is a problem. Although there are PAs protected by law, such as the Yangoupokpi Lokchao, Kailam and Bunning WS and the proposed Siroi NP which are prime galliformes habitats, there is very little effort by the Government or other organisations to protect and conserve these wildlife habitats. There is however some effort by locals to conserve the Siroi wildlife habitat. For the last many years, the Siroi Youth Club and more recently an organization called Mungleng Vatheh Hill Development Organisation based in Siroi village (Ukhrul district, Manipur) have been engaged in conservation and protection of the Siroi-Kashong hill range. There is also



some effort by the Tokpa Kabui villagers (Henglep subdivision, Churachandpur district, Manipur) to conserve their forest which is potential habitat for galliformes species. This forest is an important catchment of the Loktak lake and the Leimatak river – a secondary tributary of the Barak river. Similarly, there is a laudable effort by Khambi village (Phungyar subdivision, Ukhrul district, Manipur) to conserve community forest area which is possible jungle fowl habitat. In Nagaland, the efforts by the Khonoma village council for declaring the forest adjacent to this village as a community conserved forest area for protecting the habitat of Blyth's tragopans has become quite successful to protect Blyth's and other associated species.

Conclusion

Studies on the Blyth's Tragopan at Blue Mountain NP in Mizoram have shown that these birds have confined themselves in steep slopes and cliff faces for a better shelter than the nearby primary and secondary forests, which have high anthropoid disturbances (Ghose 1997, Ghose and Thanga 1998). Information such as these could be used to address the conservation issues for the threatened galliformes species. Moreover, the recent IUCN Action Plan for the Partridges and Pheasants have made it clear that regional data and status survey of a species is much more important for its conservation rather than using a globalised pattern. In a more systematic approach to assess the extinction risk of some galliformes species, most of the earlier known endangered pheasants have been accorded a lower threat category. This is a reflection of accumulation of local knowledge, which has culminated in formulating a better assessment for poorly known species.

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21.0 Impact of Tsunami on Galliformes and their Habitats in the Andaman and Nicobar Islands

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Introduction

Andaman and Nicobar islands form two of the 218 Endemic Bird Areas of the world with over 270 species of birds (Vijayan *et al.* 2000, Sivakumar and Sankaran, 2002). Of these, 106 species and subspecies are endemic to these islands. However, the diversity of galliformes in these islands is poor and represented by only four species, *viz.*, Nicobar megapode (*Megapodius nicobariensis*), Bluebreasted Quail (*Coturnix chinensis*), Indian Peafowl (*Pavo cristatus*), and Grey Francolin (*Francolinus pondicerianus*).

The Andaman and Nicobar islands (6° 45' and 13° 41' N and 92° 12' and 93° 57' E) in the Bay of Bengal arch from Arakan Yoma in Myanmar in the north to Sumatra in Indonesia in the south (Saldanha 1989; Dagar *et al.* 1991). The islands cover an area of 8,249 km², with a total coastline of 1,962 km; the Andaman group has more than 325 islands (21 inhabited) covering 6,408 km², and the Nicobar group has over 23 islands (12 inhabited) with an area of 1,841 km² (Singh 1981; Saldanha 1989). Islands have a hot, humid and uniform tropical climate and vegetation is mostly evergreen forests and mangrove.

The Nicobar islands, can be subdivided into three distinct subgroups based on ornithological affinities (Sankaran 1997). To the south lies the Great Nicobar group consisting of two islands over 100 km² in area, nine islets less than five km² in size, and a few rocks. Great Nicobar, Little Nicobar, Kondul and Pilo Milo are inhabited. Meroe, Treis, Trax, Menchal, Megapode, Cabra and Pigeon are uninhabited islets. Fifty eight km north of the Great Nicobar group is the Nancowry group (middle Nicobar islands), which consists of three islands larger than 100 km², two of 36 and 67 km², three < 17 km², two small islets and a few rocks. Seven islands in the Nancowry group are inhabited. Tillanchong is the only uninhabited island of the group. The northernmost subgroup comprises of Batti Malv and Car Nicobar, which is

88 km north of the Nancowry group. Batti Malv is uninhabited and Car Nicobar has a population of over 19,000 people.

The earthquake of magnitude 9.15 with its epicentre at 3.29°N and 95.94°E off the coast of Sumatra with a focal depth of 30 km occurred on 26th December 2004 at 06:28:50 h. The earthquake occurred at the interface between the India and Burma plates and the epicentre was very close to the Nicobar group of islands, where both the native species of galliformes occur. The tsunami that followed was within a few minutes of the earthquake. The tsunami waves reached the coast first, causing a phenomenon called draw down, where the sea level dropped considerably (Sankaran, 2005). The draw down was followed by the crest of the wave, which resulted in sea inundating land, also known as the run-up. There appears to have been three waves in succession, with the second being the largest. The waters took several days to recede completely, leaving in its wake a devastation of unimaginable magnitude on the people and wildlife of Nicobar islands (Sankaran, 2005). It was expected that the highly diversified coastal biodiversity with high endemism may have been adversely affected by the tsunami. With this assumption, the Salim Ali Centre for Ornithology and Natural History (SACON) and the Wildlife Institute of India (WII) conducted surveys of these species with special reference to the Nicobar megapode and their habitats in the Nicobar group of islands.

Status and distribution of Galliformes in the Andaman & Nicobar Islands-Pre Tsunami

Four species of galliformes occur in these islands, two species, *viz.*, the Indian Peafowl *Pavo cristatus* and the Grey Francolin *Francolinus pondicerianus* were introduced to the Andaman islands. The other two *i.e.*, Nicobar megapode (*Megapodius nicobariensis*) and the subspecies



of Bluebreasted Quail (*Coturnix chinensis*), are endemic to Nicobars (Table 1).

The Nicobar megapode

The Nicobar Megapode *Megapodius nicobariensis*, a mound nesting megapode, is separated from its nearest congener by a distance of over 1,500 km (Olson 1980). The polytypic Nicobar Megapode has two subspecies. *M. n. nicobariensis* Blyth, is present in the Nancowry group of islands north of the Sombrero channel, and *M. n. abbotti* Oberholser, is found on the Great Nicobar group of islands lying south of the Sombrero channel (Hume 1874, Hume and Marshall 1878, Abdulali 1964 & 1967, Ali and Ripley 1983).

Megapodius nicobariensis abbotti Oberholser, 1919.

M. n. abbotti is common in all coastal forests, particularly uninhabited or sparsely inhabited areas, on Great and Little Nicobar. It is believed to have disappeared from all areas colonised by mainlanders (Dekker 1992), but they continue to survive in small remnant pockets (Sankaran 1995). Seven of the nine islets in the Great Nicobar group have habitat suitable for megapodes and two (Cabra and Pigeon) are too small. Small populations of megapodes are present on six of these seven islets. The seventh islet, Pilo Milo is inhabited, and the islet is mostly under coconut palms. Megapodes are apparently extinct on this islet. Over 50% of the forests of uninhabited Meroe, Treis, Trak, Menchal and Megapode islands have been converted to coconut plantation, and populations of megapodes on these islands are threatened (Sankaran 1995).

Megapodius nicobariensis nicobariensis Blyth, 1846.

M. n. nicobariensis occurs on seven islands of the Nancowry group (Sankaran 1995). On Camorta, Katchall and Trinkat, it is patchily distributed, with very few locations having active mounds. Good populations of megapodes exist on Teresa and Bompoka and the density of active mounds is similar to that of Great and Little Nicobar. Tillanchong is mainly hilly with very little level coastal forest, thus megapodes are naturally scarce except in the low lying coastal forests.

Grey francolin *Francolinus pondicerianus*

This species was introduced into the Andaman islands in 1890s. Sporadic sightings of this species were recorded in the deciduous forests especially from the south Andaman. However, detailed distribution and status of this species in Andaman islands is not known. Grey francolin has not been recorded from the Nicobar islands.

Blue-breasted Quail *Coturnix chinensis*

In the Nancowry group of islands of Nicobars, the central portion of the most of islands are grasslands, often extending to the coast itself (Sankaran 1995). Various explanations exist for the occurrence of these grasslands, the main being that they are man-made. However, there is no historic evidence that colonizers cleared forests for animal husbandry. The existence of the Blue-breasted Quail in these grasslands is an indication that these grasslands are so old that not only did colonization take place, but speciation occurred as well. The subspecies *C.c. trinkutensis* present here is believed to be endemic to these islands. Blue-breasted Quail is common on Car Nicobar, Trinket and Camorta islands. Around 12-15 sightings of this species

Table 1 : Galliformes of Andaman and Nicobar islands.

S.No.	Species	Status	Distribution	Current Population status
1	Nicobar Megapode <i>Megapodius nicobariensis</i>	Vulnerable	Nicobar islands	Coastal population around 800 breeding pairs
2	Grey Francolin <i>Francolinus pondicerianus</i>	Not known	Andaman islands	Not known
3	Bluebreasted Quail <i>Coturnix chinensis</i>	Common in Nicobars	Nancowry group and Car Nicobar islands	Common in the grassland areas
4	Indian Peafowl <i>Pavo cristatus</i>	Rare	Andaman islands	Not common



was recorded during the 1993-94 surveys (Sankaran 1995).

Indian Peafowl *Pavo cristatus*

The Indian peafowl is one of the introduced birds in Andaman islands. Their distribution is restricted to in and around the Port Blair and Ross Island in the Port Blair. Total number of Blue Peafowl in Andamans may not exceed 50 individuals.

Impact of Tsunami on Galliformes

Impact of Tsunami on the Nicobar megapode

Of the total 687 km long coastal line of the Nicobar islands, 328 km long coastal forest is identified as the 'Potential Coastal Habitat for Megapode' and remaining 359 km long coastal forests are identified as 'Non-conductive coastal habitat for megapode' (Sivakumar, 2007). Presently, about 800 breeding pairs of the Nicobar megapode occur on the coastal habitat of the Nicobar islands, which is nearly 70% less than what was reported a decade before (Sankaran 1995 and 1996).

Megapodius nicobariensis nicobariensis

M.n.nicobariensis occurs on all seven islands of Nancowry group of islands. The potential coastal habitat of this sub species has reduced as a result of the tsunami and only 37% of the coastal habitat is now available to build mounds. Of the existing population of this subspecies nearly 50% occurs in Tillanchang and Trinket islands. In 1993-94, good density of megapodes was present in Teressa and Bompoka islands (Sankaran 1995). Presently, Bompoka Island is again better off when compared to Teressa where more than 90% of population vanished. Sankaran (1995) estimated 119 active mounds and observed 113 abandoned mounds on Teressa Island. Similar sampling effort post tsunami resulted in an estimation of only nine active mounds and abandoned mounds were not observed in coastal forests.

The megapodes populations on major islands such as Camorta, Katchal, Teressa and Nancowry was estimated at around 63 breeding pairs which is 88% less than what was in 1993-94. All major islands in this group is thickly populated by mainly indigenous people who are known to hunt megapodes.

Sankaran (1995) has earlier cautioned about the growing tribal population and the resultant conversion of primary coastal forest to coconut and other plantations, which continue to encroach into megapode habitat. Though, tsunami is the primary factor for the decline of megapodes in the Nicobar islands, the other factors which might have adversely affected the megapodes pre tsunami is the large scale encroachment of coastal forest for coconut and other plantations, and hunting. The Tillanchong Island is a protected Wildlife Sanctuary where the megapode population shows an increasing trend. In Tillanchong, few mounds have however been observed with leg-snares on it probably fishermen. Though, the larger portion of Trinket Island is inhabited by humans, the southern part is comparatively undisturbed where good numbers of megapodes are found.

In general, the population of *M.n.nicobariensis* has been continuously declining on all islands except Tillanchong and Trinket. Overall, there is a 70% of population decline in this sub species post tsunami.

Megapodius nicobariensis abbotti

Post tsunami, *M.n.abbotti* occurred on all southern group of Nicobars barring Pilo Milo, Megapode and Trax islands where the populations of megapodes either became extinct or too small to detect.

Of the 314 km long coast line, 61% of coastal low-lying forests have been identified as the potential coastal habitat of megapodes. On this potential coastal habitat, it was estimated that 286 active mounds were present. On the non-conductive coastal habitat of this group of islands, 11 mounds were counted. Collectively, the total number of active mounds found on the coastal forests of southern group of Nicobars was 297. It has been estimated that a total of 594 breeding pairs occurs on the coastal habitat of these islands.

The largest population of megapodes occurred on Great Nicobar Island where 405 breeding pairs have been estimated. The second largest population is in the Little Nicobar Island. Both islands are largest in this group and have 96% of megapodes. However, when compared to previous survey (Sankaran 1995), 65% of megapode *M.n.abbotti* has disappeared from these two islands.



Significant populations of megapode were present on both north-eastern and western coastal forests of the Great Nicobar. However, most of active mounds found were smaller in size. High density of megapodes found on the southern tip of the Great Nicobar (Sankaran 1995, Dekker 1992) in the past has been washed away where the influence of tsunami waves were witnessed up to five km inside the forests. Large sized mounds have been located on the north-eastern coastal areas of the Great Nicobar, where the indigenous Shompens live, and they were not affected by tsunami much.

Grey francolin *Francolinus pondicerianus*

Sporadic sightings of this species were recorded in the disturbed open forests especially from the south Andaman. However, detailed distribution and status of this species in Andaman islands is not known. Grey Francolin is not recorded from the Nicobar islands. Impact of tsunami was minimum in the Andaman islands when compared to Nicobars, therefore, it is assumed that there would have been no impact on this 'introduced' species.

Blue-breasted Quail *Coturnix chinensis*

Blue-breasted Quail was common on Car Nicobar, Trinket and Camorta islands. Around 12-15 sightings of this bird was recorded during 1993-04 survey (Sankaran 1995). However, during the rapid survey that was carried out in the grasslands of Camorta, Trinket, Teressa and Bamboka islands during June 2006, a total of 54 birds were recorded. Maximum number of birds were recorded in the grasslands of Camorta (29 birds) followed by Teressa, Bomboka and Trinket. Blue-breasted Quail were sighted often with Yellow-legged Button quail *Turnix tanki*, whose, sightings was not rare in the Nicobar islands

Since there was no detailed and systematic survey carried out before and after tsunami it would be difficult to comment on impact of tsunami on the status of this species. However, after tsunami, most of the grasslands in Camorta and Teressa were used for housing and plantations without considering their ecological values, which definitely have endangered this species and its habitat.

Indian Peafowl *Pavo cristatus*

Indian peafowl is one of the introduced birds in Andaman islands. Their distribution is restricted to in and around the Port Blair and Ross Island. Total number of peafowl in

Andamans may not be more than 50 individuals. Impact of tsunami was minimum in the Andaman islands when compared to Nicobars, therefore, it is assumed that there would have been no impact on this 'introduced' species.

Post tsunami impact on galliformes

Since the tsunami waves have washed away most of the planted as well as wild coastal coconut and areca nut palms, plantation of these palms has become important for the future survival of tribals of this region. It is likely that during the post tsunami recovery period the plantations will encroach into the remaining potential coastal habitats of the Nicobar megapode. After tsunami most of the low-lying coastal areas submerged and megapodes have built their mounds in evacuated villages. But, when the tribals started returning, they began hunting the megapodes. More than 95% of coconut plantations on the southern group of Nicobar islands were washed away, which was the major source of income for tribals. In years to come, it is expected that tribals will be left with fishing and hunting of wildlife for their survival apart from livelihood support from the Government. Each tribal family has one to four air guns, and they use them for hunting Nicobar megapode, Pied Imperial Pigeon, Andaman Green Imperial Pigeon, Green Pigeon and Nicobar Pigeon.

Conservation

Around 70% of the population of Nicobar megapode had disappeared, and it is apparent that this was primarily due to the tsunami which washed away their habitat along with nests (Sivakumar, 2007). However, habitat destruction and hunting are the major human induced factors still adversely affecting the megapodes, and these forces are likely to continue until a serious conservation programme is implemented. Restoration of the megapode habitat on the west coast of the Great Nicobar Island is urgently required. A conservation awareness programme needs to be initiated immediately through tribal captains of Nicobarese villages. This programme should clearly address reasons for the decline in Nicobar megapode populations, and how these trends can be arrested or reversed. Since the habitat destruction is a major human induced cause for the decline of megapodes, it needs to be communicated properly. Further plantation or developmental activities must be contained and expansion of plantation area in newer forest land should not be allowed. Since there is a strong relationship between poverty, development and wildlife conservation, further developmental activities aimed to eliminate poverty



need to be encouraged without undermining the importance of wildlife.

After the tsunami, hunting on megapode seems to be on the increase. Though, the Nicobarese attach traditionally cultural values to megapodes, scarcity of animal protein has forced them to hunt megapodes intensively.

Scientific knowledge on the ecology of a species is necessary for *in situ* management of populations. It is important to know the population dynamics and the factors that influence the population dynamics of this species.

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22.0 Impact of Anthropogenic Pressures on Abundance and Distribution of Galliformes at Bedini-Ali, Nanda Devi Biosphere Reserve, Uttarakhand

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Introduction

The Pheasants of the Himalaya are one of the most charismatic and conspicuous of all fauna of this region. They are regarded as the most distinctive bird family of Himalaya due to their high endemism and brightly coloured plumage (Ali, 1981). They are considered as indicators of habitat quality as they depend substantially on understorey and ground layer vegetation. They also form prey base for many carnivores. The pheasant populations have undergone heavy depletion due to excessive hunting and poaching, and a large tract of their natural habitat has been encroached upon for human needs.

Gaston *et al.* (1981, 1983), Sharma (1989), Gaston and Garson (1992), Gaston *et al.* (1993), Kaul and Garson (1993), Sharma (1993), Sathyakumar *et al.* (1993b), Sankaran (1993), Pandey (1993), Ramesh (1999), Jandrotia (1999) and Sathyakumar (2004) have presented information on status and distribution of pheasants in the western Himalaya based on short studies and/or surveys. Intensive studies on pheasants in the Western Himalaya were carried out by Kaul (1992) on Cheer pheasant in Kumaon, Uttarakhand; Sharma (1992) on Kalij in Garhwal, Uttarakhand and Ramesh (2003) on Western Tragopan, Himalayan monal and Koklass at Great Himalayan National Park (NP) in Himachal Pradesh. A few studies have been carried out to assess the ecological aspects of galliformes in subalpine and alpine areas of western Himalaya. Sathyakumar *et al.* (1993a) gathered information on habitat use and relative abundance of pheasants; and Kumar (1997) documented winter

habitat use by Himalayan monal in Kedarnath Wildlife Sanctuary (WS). Ramesh *et al.* (1999) investigated ecology of pheasants and discussed the effect of anthropogenic pressures on their abundance and distribution in Great Himalayan NP. All other information on pheasants in the western Himalaya are either from lower altitude or in the form of short studies, surveys or supplementary information collected from other faunal studies.

The Nanda Devi NP (625 km²) is one of the least disturbed Protected Areas (PA) in the western Himalaya, and forms one of the core zones of the Nanda Devi Biosphere Reserve (BR) (5,860 km²). The status and distribution of Himalayan monal and Koklass pheasants in Nanda Devi NP and BR are based on surveys conducted by Sankaran (1993) and Sathyakumar (2004). There is a lack of information on the status of wildlife particularly galliformes and their habitats in the buffer zones of Nanda Devi BR where several villages are located and a substantial human and livestock population depend upon the natural resources. To understand the effect of anthropogenic pressures on pheasants and their habitats, a study was carried out at Bedini-Ali located in the buffer zone of Nanda Devi BR during 2005-06. This study estimated the relative abundance of galliformes and assessed the distribution and habitat use by galliformes with reference to anthropogenic pressures in the study area. This paper presents the impacts of anthropogenic pressures on galliformes at Bedini-Ali, Nanda Devi BR, Uttarakhand.



Study Area

An intensive study area of ca. 20 km² was selected in the western region of Nanda Devi BR covering Bedini- Ali-Roopkund area (79°40' N, 30°12' E) which encompasses the upper temperate, subalpine and alpine regions (3,000 to 5,000 m), diverse slope and aspect categories along with a range of human and livestock use. Vegetation of the study area includes alpine meadows (herbs, forbs, grasses and sedges), treeline or *Krumholtz* zone dominated by *Rhododendron campanulatum* and Subalpine forests dominated by *Quercus semecarpifolia* and *Abies pindrow*. The average maximum temperature was recorded in the month of June (17.7°C) while the minimum was recorded in January (-10°C) at Bedini during the study period. The study area received over 200 mm rainfall during the month of August 2005. Wan and Didhna are the two main villages lying west and south west of the study area. The study area is used by resident as well as migratory livestock and by local people for their natural resource needs.

Methods

Rapid assessment surveys were carried out at the beginning of the study to assess the status and distribution of pheasants, and their habitats, extent of human and livestock use in different parts of the study area. Following this, sampling was done along gradients of varying human use between 3,000 and 3,550m elevation. This involved laying and monitoring of trail/ transects (n=7; 1.6 to 2.1 km) [Table 1], call count stations (n=4) and wildlife habitat evaluation studies following Sathyakumar *et. al* (1993a), and Ramesh *et al.* (1999) [Fig.1]. These transects were sampled thrice a month for pheasant abundance and habitat use. Total count for livestock (cattle, buffaloes, goat, sheep, horses and mules) was also carried out once every month. Numbers of cut, lopped and debarked trees in 10 × 10m plots (n=312, 3 plots at every 100m interval along each transect) were used to estimate the anthropogenic pressure. The effects of species, season and spatial grazing pressure and their interactions on pheasant abundance was analyzed through general linear model.

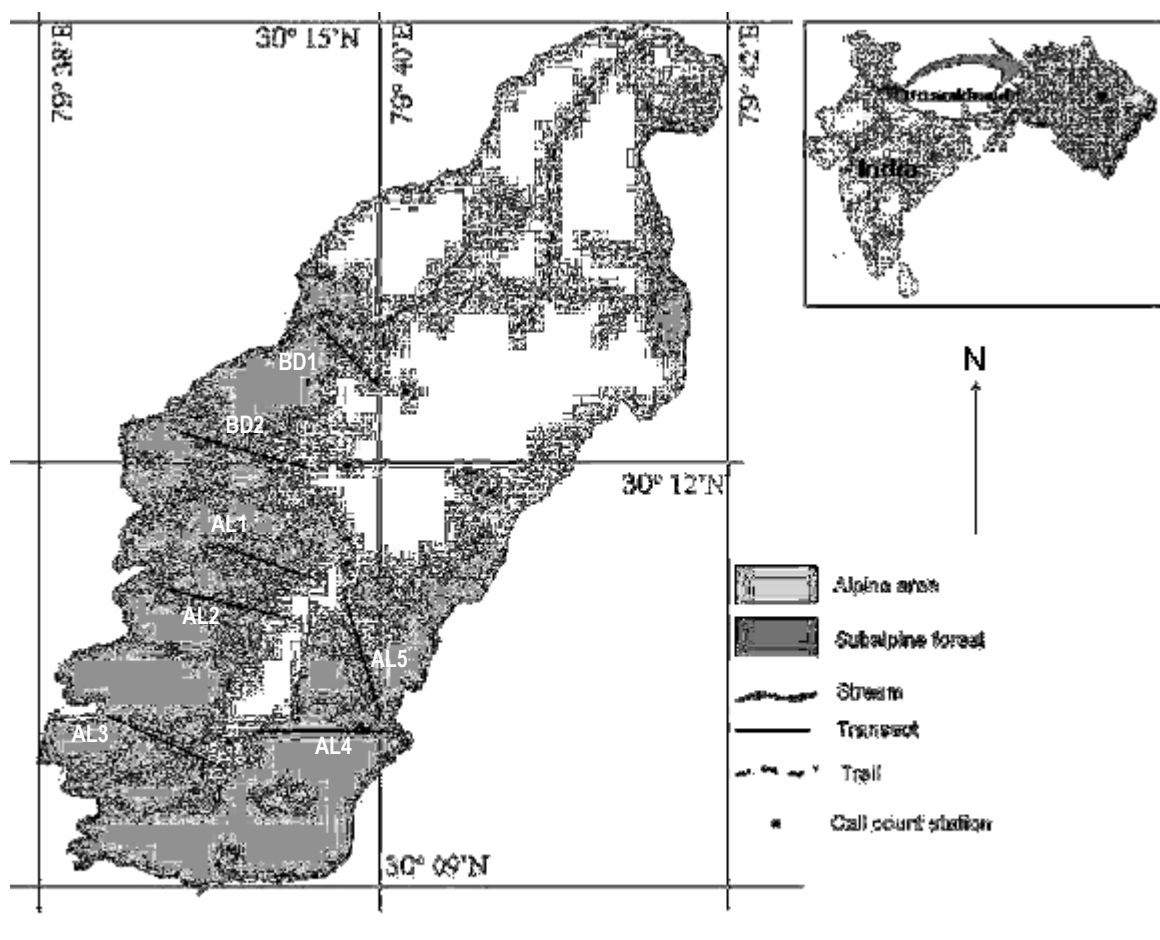


Figure 1. Map of Bedini-Ali meadows showing the transects and call count points



Habitat use

Integrating the 12 habitat parameters, Principal Component Analysis (PCA) extracted two components which accounted for 52 % of the variability in the data set (Table 7) for autumn and spring as both galliformes and livestock were present in the study area in these seasons. In this case, altitude and rock cover showed highest positive loading and grass cover showed negative loading to component 1 whereas anthropogenic pressures showed highest positive loading in component 2. The points are plotted in scatter plot to visualize the distribution of the sightings along the two components (Fig.4). Two different clusters were formed. There is an apparent difference in the use of habitat parameters between Snow partridge, Himalayan Snowcock, Himalayan monal and Koklass during autumn and spring. Himalayan Snowcock and Snow Partridge were ecologically separated from other galliformes as they used high altitude steep terrain where anthropogenic pressure was low. Himalayan monal and Koklass had to share the habitats with herded livestock during spring and autumn.

A comparison of abundance of monal and Koklass pheasants between the study area (Bedini-Ali) and other adjacent areas (Nanda Devi NP, Kedarnath WS) revealed that the abundance of monal is higher inside the Nanda Devi NP but similar to Tunganath region in Kedarnath WS, which is also subjected to anthropogenic pressures (Table 8). However, Koklass abundance estimate in Bedini is similar to Nanda Devi NP, but lower than Kedarnath WS.

Results

Estimation of anthropogenic pressures in the study area during 2005 -06 showed that the area along the transect AL-5 had highest percentage (41.99%) of livestock presence and BD-2 had highest percentage (23.84%) of use by local people and pilgrims. AL-5 had highest percentage of cut, lopped and debarked trees (43.66%). Overall estimate of anthropogenic pressures along different transects during different seasons showed that the presence of local people is the only major disturbance factor in winter. In spring and summer, livestock grazing and cutting, lopping and debarking of trees were the major anthropogenic pressures. More than 4,000 livestock (4,628 goat and sheep and 233 cattle) used the study area for grazing in the alpine regions (3,000 to 4,000m) from May to October.

Abundance estimates of galliformes

Among the galliformes, four species, Himalayan Monal *Lophophorus impejanus*, Koklass *Pucrasia macrolopha*, Snow Partridge *Lerwa lerwa* and Himalayan Snowcock *Tetraogallus himalayensis* were encountered in the study area. Himalayan Snowcock and Snow Partridge were encountered only in alpine habitat (>3,500m) whereas Himalayan monal and Koklass were found mainly in subalpine forest and treeline region (3,000 to 3,500m).

During 2005 and 2006, the Himalayan Monal was most commonly encountered in the subalpine forests, 'treeline' and alpine regions of the study area. It was sighted on 299 occasions (393 individuals) [Table 2]. The encounter rate for monal was $1.22 \pm 0.068 \text{ km}^{-1} \text{ walk}$. Density estimate for monal was $36.37 \pm 2.69 \text{ km}^2$. Abundance of monal was estimated in four different seasons. Density and Encounter Rate both were highest during spring and lowest in summer (Table 3).

Koklass was sighted on 53 occasions (63 individual) and its encounter rate was $0.67 \pm 0.01 \text{ individual km}^{-1} \text{ walk}$. Density estimates (km^2) for Koklass was 28.54 ± 2.44 . Abundance of Koklass was estimated in four different seasons. Density and Encounter Rate both were highest during spring and lowest in summer (Table 4). Density estimates were varying significantly between species, season and disturbance (Table 5). Call counts were done only for Koklass pheasant. Overall mean call count estimate for Koklass in spring, 2006 was $1.96 \pm 0.22 \text{ male sampling stations}^{-1} (n=26)$. Among the four calling stations (two in Ali meadow and two in Bedini meadow), mean call count estimate was highest in AL1 station and lowest in AL5 station (Table 6).

Discussion

There was a significant variation in anthropogenic pressures among transects ($p < 0.05$, one way ANOVA) and similar transects were pooled to find how pheasants are responding to a spatial gradient of anthropogenic pressures. Pheasant abundance was lowest during summer when presence of human in the pheasant habitats was highest. During spring, abundance of pheasant was highest for both Himalayan monal and Koklass. Call counts for Koklass pheasant showed lowest estimate for male station⁻¹ along AL5 Transect, which was frequently visited by livestock accompanied by herders



and shepherd dogs. Comparison between density estimates of pheasants (Monal and Koklass) in different transects during peak grazing season in the study area revealed significant difference ($p < 0.05$, one way ANOVA) [Fig 2]. During non grazing seasons (winter, late spring and early autumn), no significant difference was found in the density estimates of pheasants (Monal and Koklass) along different transects of the study area ($P > 0.83$, one way ANOVA) [Fig 3]. This result indicates that the pheasant populations were clumped in some undisturbed area of the study area (Transect AL1 and BD1) during the peak grazing season

as most of their habitat was occupied by livestock. During the non grazing season, the absence of livestock from the study area may be the reason for the uniform distribution of pheasants in all available habitats (along all transects in the study area). Overall density estimates of pheasants showed that Himalayan monal was more abundant than koklass pheasant in the study area. Seasons and transects were indicators of grazing pressures and there was no significant difference in the interaction between individual species densities and grazing pressures. Hence, both the species were less abundant under higher grazing pressures, both spatially and temporally.

Table 1 : Characteristics of Transects laid in the Study Area

Transect ID	Elevation (m)	Length (km)	Aspect	Human use
AL1	3160-3500	1.5	West	Moderate
AL2	3150-3450	1.5	West	High
AL3	3090-3450	1.5	West	Low
AL4	3000-3525	1.5	East	Low
AL5	3000-3480	2.0	East	High
BD1	3200-3520	1.5	West	Low
BD2	3000-3475	1.2	West	Moderate

Table 2 : Galliformes sightings in the Study Area during 2005-06

Species	Sightings	Individuals	Group Size	
			Min	Max
Himalayan Monal	299	393	1	5
Koklass Pheasant	53	63	1	2
Himalayan Snowcock	14	25	2	5
Snow Partridge	23	43	4	10

Table 3 : Abundance of Himalayan Monal in different Seasons in the Study Area

Seasons	Sightings	Density (km^2) \pm SE	ER ($\#/\text{km}$) \pm SE
Summer	8	17.89 \pm 5.86	0.72 \pm 0.29
Autumn	91	34.14 \pm 5.95	0.95 \pm 0.13
Winter	80	33.14 \pm 4.45	1.05 \pm 0.97
Spring	120	44.43 \pm 5.25	1.45 \pm 0.13
Overall	299	36.37 \pm 2.69	1.22 \pm 0.07

Table 4 : Abundance of Koklass in the Study Area during different Seasons

Season	Sightings	Density (km^2) \pm SE	ER ($\#/\text{km}$) \pm SE
Summer	2	3.24 \pm 2.53	0.10 \pm 0.07
Autumn	20	31.69 \pm 4.57	0.69 \pm 0.03
Winter	19	36.09 \pm 4.21	0.65 \pm 0.01
Spring	12	38.27 \pm 5.60	0.68 \pm 0.02
Overall	53	28.54 \pm 2.44	0.67 \pm 0.01

**Table 5 :** Effects of species, season, grazing pressures and their interactions on pheasant density estimates

Source	SS	df	Mean Square	F	p
Corrected Model	6383.99	5	1276.80	9.92	0.00
Intercept	4172.87	1	4172.87	32.43	0.00
SPECIES	1543.50	1	1543.50	11.99	0.00
SEASON	913.69	1	913.69	7.10	0.01
Disturbance categories (DC)	698.41	1	698.41	5.43	0.03
SPECIES * SEASON * DC	650.75	2	325.38	2.53	0.10
Error	2831.21	22	128.69		
Total	18199.21	28			
Corrected Total	9215.20	27			

R Squared = .693

Table 6 : Call Count Estimates for Koklass in different Calling Stations in the Study Area

Calling Stations	N	No. of Male Station ¹ ± SE
AL1	8	2.86±0.26
AL5	6	0.83±0.40
BD1	7	2.38±0.18
BD2	5	1.40±0.60
Overall	26	1.96±0.22

Table 7 : Component matrix of PCA of habitat parameters used by Galliformes in the Study Area

Sl no.	Habitat Parameters	Component 1	Component 2
1	Slope	-0.245	-0.112
2	Altitude	0.837	-0.040
3	Grass cover	0.846	0.183
4	Grass height	0.843	-0.076
5	Herb cover	0.113	0.232
6	Herb height	0.221	0.079
7	Litter depth	-0.703	0.248
8	Rock cover	0.321	0.310
9	Barren	-0.814	-0.361
10	Cut	-0.219	0.770
11	Lopped	-0.094	0.836
12	Debarked	-0.135	0.745

Table 8 : Comparison of Encounter Rate (#km⁻¹ walk) of Pheasants in Bedini-Ali with Other Protected Areas of Uttarakhand

Species	Bedini-Ali	Nanda Devi NP ¹	Kedarnath WS ²
Monal	0.7 - 1.45	0 - 2.28	1.4
Koklass	0-2 males calling station ⁻¹	0-1 male calling station ⁻¹	4-5 males calling station ⁻¹ *

¹ Sathyakumar 2004, ²Sathyakumar *et al.*1992; *Sathyakumar (2005, *pers.comm.*).

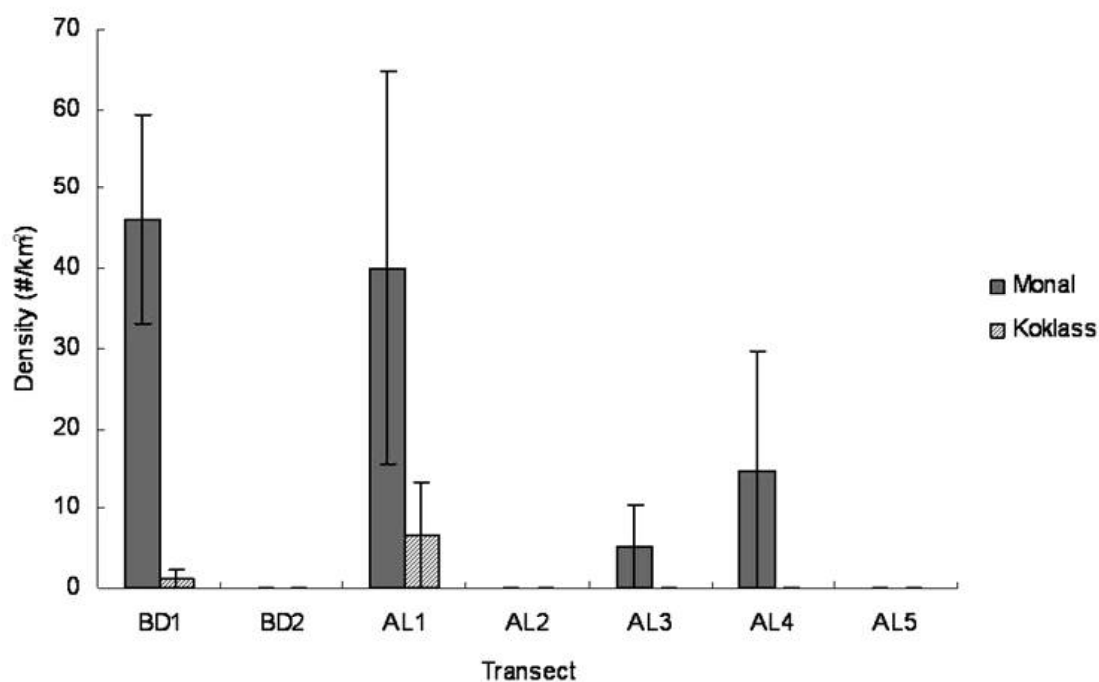


Figure 2. Density of pheasants in different transects during peak grazing season (summer)

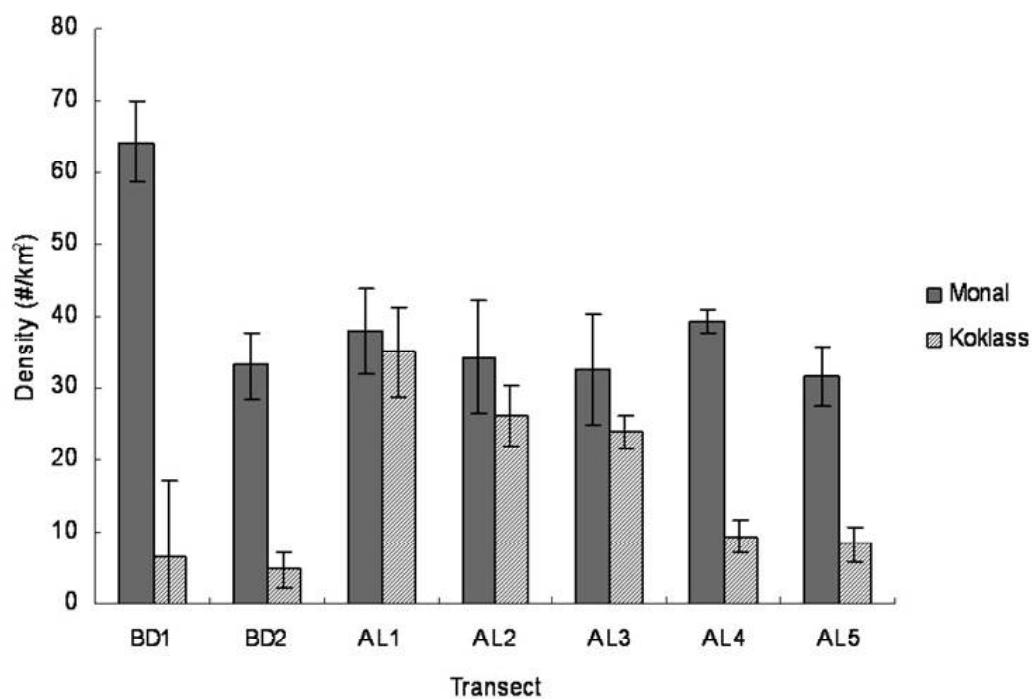


Figure 3. Density of pheasants in different transects during non grazing seasons (autumn, winter, spring)

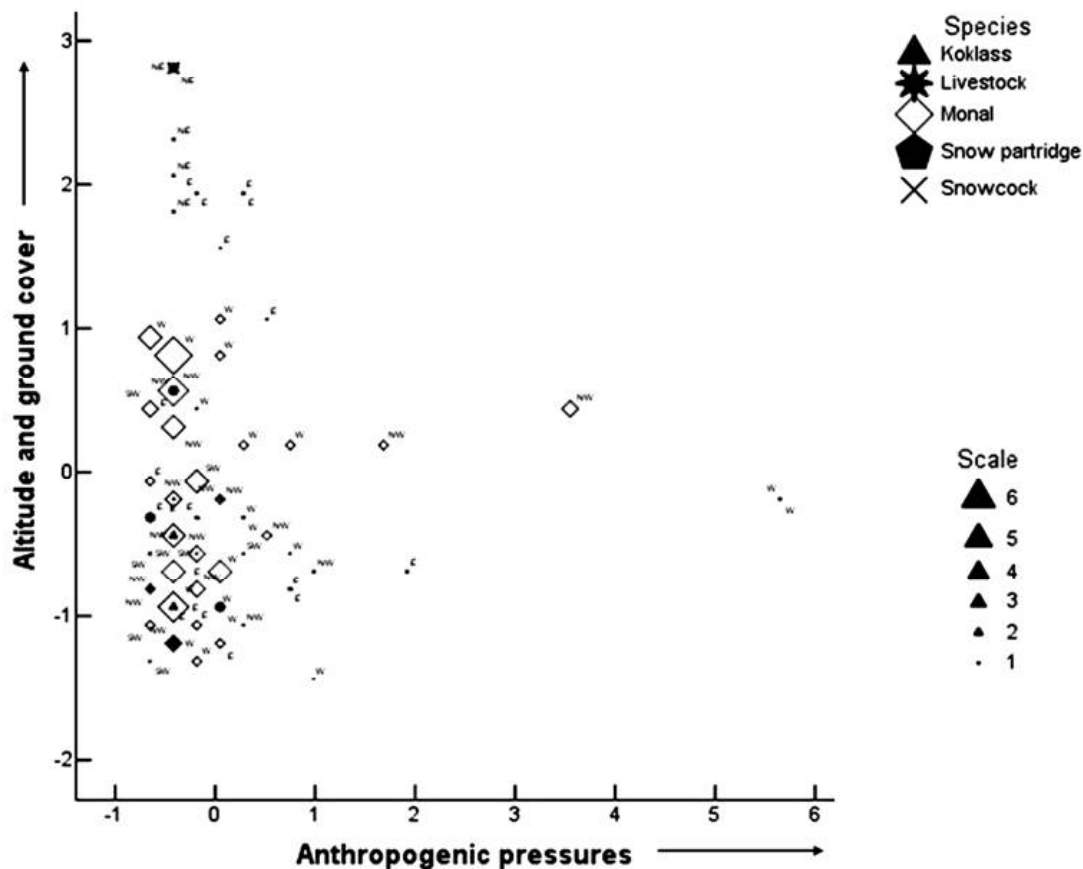


Figure 4. Distribution of Galliformes sighting along two principal habitat components

Conservation Implications

Galliformes in Bedini-Ali are using habitats which are subjected to different forms of anthropogenic pressures such as livestock grazing, NWFP collection and tourism. NWFP collection includes fodder grasses, montane bamboo, nuts, fruits, and medicinal and aromatic herbs. Fodder collection is practised throughout Bedini-Ali without any restriction. During the month of May, extraction of *Cordyceps sinensis* (rare medicinal fungi, highly demanded by Tibetan traders) from the alpine region and glacial moraines of the study area causes disturbances to the wildlife and their habitats. During May 2006, 13 camps of the fungi collectors and more than 500 people including local villagers and outsiders were observed collecting fungus in the habitat used by Himalayan Snowcock and Snow Partridge. Along with this, another economically important mushroom *Morchella esculenta*, lichen *Chaerophyllum* sp. and montane bamboo *Arundinaria spathiflora* collection by local people from the subalpine forests also causes removal of ground, tree and shrub cover. These uncontrolled NWFP extraction

particularly during April-May (spring season), may cause adverse impacts to galliformes and their habitats as it is the breeding season also. Ramesh *et al.* (1999) observed a sharp decline in pheasant abundance estimates in Great Himalayan NP, Himachal Pradesh, presumably, due to breeding loss because of extreme level of disturbance caused by uncontrolled mushroom collection activities. These activities need to be regularly monitored and restricted to minimize their impact on galliformes and their habitats.

Large number of tourists visits the study area from April to December. During the period August 2005 to June 2006, a total of 129 tourist groups along with 383 pack animals visited the study area particularly Bedini meadow and Himalayan snowcock habitat of Kurumtoli and Baguabasa as these areas are part of the trekking route to Roopkund. Camping and littering in these areas caused considerable damage particularly in Bedini meadow as well as other parts of the study area.



The impact of livestock grazing on wild animals and their habitats has been reported by Sathyakumar *et al.* (1993b). Increasing use of livestock grazing has led to decreasing Himalayan musk deer and goral densities (Sathyakumar 1994) in Kedarnath WS. Similarly, presence of livestock along with people and shepherd dogs has an adverse impact on the galliformes populations in the subalpine forests and alpine rangelands. A further increase in the livestock population will negatively affect the rangeland and galliformes populations in the Bedini Ali region. Management authorities need to address all the constituents *i.e.*, the requirements of local residents (villagers of Wan, Ballan, Kuling and other villages situated in Dewal block) and their livestock, and the conservation of the wildlife in this area. Therefore, participatory planning is essential to rationalize realistic goals of both pastoral production and wildlife conservation in the area.

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23.0 Galliformes Hunting in India : The Bigger Picture

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Introduction

Galliformes are viewed as significant source of easily accessible animal protein, as they often occur close to rural communities in many areas of India. In the Himalayan and the northeast states of India a significant portion of wild meat offtakes comprises of galliformes (Kaul *et al.* 2004; Hilaluddin *et al.* 2005a; 2005b, 2006). There are also high values attached to the subsistence use of, and the commercial trade of galliformes, making it an important source of livelihood, albeit illegal, for rural and urban traders in the northeast India and the eastern Indian Himalaya.

As human population is continuously burgeoning, pressures on natural resources and wildlife in India in general and northeast India in particular are becoming increasingly severe. Greater access to forest areas, the adoption of modern firearms and their continued use in hunting practices, and the increasing commercialization of hunting (Kaul *et al.* 2003 ;2004; Hilaluddin *et al.* 2004, 2005a; 2005b ; 2006) are critical factors driving exploitation of several pheasant species, specifically in the western Indian Himalaya (Hilaluddin 2006). The threat of extinctions of local galliformes populations from many areas of the Himalayan region and northeast India and associated declines in meat supplies for local communities are therefore concerns shared by those engaged in the conservation of biodiversity and those pursuing the betterment of human. History suggests that people switch to alternate sources of protein and livelihoods when wild meat is rare, but often at a point when recovery of a depleting wildlife species is too late (Rao and McGowan 2002). The recent most example in this context, is the local extinction of Green Peafowl (*Pavo muticus*) from parts of

southeast Asia (McGowan *et al.* 1998). Keeping the above in view, the present article reviews researches that were conducted on galliformes extractions in some areas of India, examines extent of the problem, exploring possibilities of future research that will help in the development of conservation action plans and forwarding ways for mitigating the problem.

Methods

Specific tribes from various states of Himachal Pradesh, Uttarakhand, North Bengal, Sikkim, Arunachal Pradesh, Nagaland and Mizoram were interviewed to determine the approximate extraction rates of wild meat within those communities. Structured questionnaires were used at the village and household levels to collect information on the species and the magnitude of the offtakes for each species. Numbers extracted per annum for each species was determined, which was then multiplied by the body weight of that species to give an approximation of the total wild meat offtakes. Since the survey was questionnaire based, it was assumed that minimum quantities of animals hunted were actually reported and that what was provided were the minimum quantities. It would also be important to note here that the figures provided are true for the communities for which the survey was conducted and may not necessarily represent the whole state. Therefore the reference made to the state below should be taken as that made to the particular tribe or the sampled area (Table 1).

Table 1 : The Surveyed Localities and Tribes

S.No.	Location/Tribe	State
1.	Chamba District	Himachal Pradesh
2.	Garhwal	Uttarakhand
3.	Nishis/ Hill Miris/Apatanis	Arunachal Pradesh
4.	Angamis	Nagaland
5.	Mizos	Mizoram
6.	Sherpas	West Bengal
7.	Kitam WS	Sikkim



Galliformes extraction rates and patterns

Studies on wildmeat harvest in the Indian Himalaya (Kaul *et al.* 2003, 2004; Hilaluddin *et al.* 2005c, 2006) and northeast India (Hilaluddin *et al.* 2005a and 2005b) have shown that at least 17 species of galliformes are commonly hunted in the sampled villages/ localities of these states. Hunters killed more galliform species (Table 2) in Nagaland (7), Himachal Pradesh (6), Sikkim (6), and Uttarakhand (6) as compared to Arunachal Pradesh (4), Mizoram (4) and north Bengal (4). The number of galliformes species that are hunted in the sampled localities is presented in Table 3.

Contribution of galliformes into wild meat off take

Galliformes contributed significantly to wild meat offtakes (Hilaluddin *et al.* 2005b) and their contribution was highest in the sampled areas/ localities of Himachal Pradesh followed by Uttarakhand, Arunachal Pradesh and Nagaland (Table 4). In the surveyed villages of Himachal Pradesh, a household extracted an average of approximately 268 kg wild meat annually, of which 8.46% was of galliformes origin. Species such as Koklass pheasant (*Pucrasia macrolopha*) and Chukar partridge (*Alectoris chukar*) made bulk of contribution into wild meat spectrum of galliformes origin. The threatened Western Tragopan (*Tragopan melanocephalus*) was also consumed. In Uttarakhand, a household on an average extracted 216 kg wild meat annually, of which 5.2% came from galliformes. Species such as Kalij Pheasant (*Lophura leucomelanos*) was the commonly hunted species. In North Bengal, Hill Partridge (*Arborophila torqueola*) and Kalij Pheasant contributed significantly to wild meat offtake (approximately 211 kg / annum) of a household. Blood Pheasant (*Ithaginis cruentus*) and Satyr Tragopan (*Tragopan satyra*) too were recorded commonly hunted in Singhalila National Park (NP). Both these species have restricted distribution within Indian territory. In Sikkim also galliformes were hunted for meat – species such as Indian Peafowl (*Pavo cristatus*) was reported to be commonly hunted in the vicinity of Ketam Wildlife Sanctuary (WS). A household of Arunachal Pradesh extracted a mean of approximately 409 kg wild meat annually, of which 5% came from galliformes. In Nagaland, the annual average household extraction was ca. 652 kg which includes 3.7% of galliform origin, and in Mizoram of the 278 kg of mean annual household extraction, galliformes contribute 1.74%.

Galliformes in the markets

Market assessment in the states of Nagaland and Arunachal Pradesh revealed that five species of galliformes were on sale (Hilaluddin *et al.* 2005b). While Hill-partridge, Grey Peacock Pheasant, Kalij Pheasant and Red Junglefowl were recorded from the market of Hapoli (Arunachal Pradesh), Hill Partridge, Kalij Pheasant and Red Junglefowl were openly being sold in the local markets of Kohima (Nagaland). A mean of 5.71-kg (± 1.4 SE) meat of galliformes origin was

sold every day in the market of Hapoli, whereas an average of 12.0 kg (± 4.0 SE) per day in the local markets of Kohima.

Follow up surveys in the markets of Dimapur and Kohima (Nagaland), Hapoli and Aizwal (Mizoram) in 2006-07 (unpublished data) recorded seven species of galliformes being openly sold. These species included Blyth's Tragopan (*Tragopan blythii*), Quail spp., Hill partridge, Chinese Francolin (*Francolinus pintadeanus*), Grey Peacock Pheasant, Kalij Pheasant, and Red Junglefowl. A Kalij Pheasant was sold @ INR 300-350; Grey Peacock Pheasant @ INR 350-400; a Blyth's Tragopan @ INR 500-600, a Red Junglefowl @ INR 250-300; a Hill partridge and Chinese Francolin each @ INR 200-250; Quail spp. @ INR 50-60.

Methods of hunting

Hunting is rarely considered a full time profession (except in case of commercial hunters) with most practitioners hunting in their spare time. The method of killing varies from traditional bow and arrows, spear, traps made from bamboo and iron wire and mist nests to modern firearms (air and smoke guns). Thirty-one percent hunters each used guns and traps, whereas 38% made use of other tools to kill galliformes in the surveyed villages across the Indian Himalaya and northeast India.

In northeast India and the Indian Himalaya (Kaul *et al.* 2003 and 2004; Hilaluddin *et al.* 2005a, 2005b, 2005c and 2006), respondents killed galliformes through regular snaring in the vicinity of villages, primarily for providing food for family. Sometimes they also organized hunting trips targeted mainly for galliformes in the nearby forests, mainly for subsistence requirements.

Our interviews with local communities included aspects such as the awareness of wildlife legislation, community hunting regulations, and the need for conservation. Forty percent hunters were prepared to stop hunting if domestic meat was supplied to them free of cost. A majority (58%) of our respondents were aware that hunting of wild animals is violation of the Wildlife (Protection) Act, 1972. The enforcement of this act had adversely impacted hunting intensities of 40% hunters. Ninety percent of our respondents admitted that customary laws of hunting that regulates animal killing did not exist within their community.

Impact of hunting on wild populations of galliformes

Recent study (Hilaluddin 2006) in the western Indian Himalaya has shown that pheasant densities, and metabolic and crude biomass varied between hunted and protected sites (PAs). In general, densities and metabolic and crude biomass of pheasant species were higher in protected sites as compared to hunted sites. Koklass pheasant and Kalij pheasant have shown statistically significant variations in



their densities in hunted versus protected sites. However, the densities of Cheer pheasant (*Catreus wallichii*) and Himalayan Monal (*Lophophorus impejanus*) did not show significant differences between hunted and protected forests although cheer pheasant were more often sighted in hunted forests than protected forests, whereas abundance of Himalayan Monal showed reverse trends. However, this is based on the assumption that PAs afford higher protection levels to galliformes *i.e.*, comparatively less poaching than areas that are outside PAs. Such an assumption may not be true in all cases, and a reverse situation is also possible.

Discussion

In the surveyed villages/ localities, 11 species of pheasants occurred and all of them were hunted commonly. Among these, Blyth's tragopan, Cheer pheasant, Red Junglefowl, Satyr Tragopan and Western Tragopan are of conservation concern. While Red Junglefowl is believed to be genetically threatened, others are listed in the Red Data List of IUCN (see IUCN 2004). Like other wild animal species in India, galliformes too are protected from hunting under the aegis of the Wildlife (Protection) Act, 1972 (WPA, 1972). All species of galliformes are listed in various schedules of the WPA, 1972. Despite enforcement of the law, it does appear that galliformes are harvested in pockets throughout their respective ranges at will, for subsistence and also for trade. They are also extracted for cultural reasons (Hilaluddin *et al.* 2005b), wild meat being perceived as 'superior' to the meat from domestic animals (Hilaluddin 2005a) and is recorded by the respondents as "*tastier*" (Hilaluddin 2005b and 2005c). This is apparent in the open wild meat markets where galliformes are sold at 2 to 3 times the price of a poultry fowl. In remote villages where access to open markets are limited, galliformes and other wild animals constitute a free resource, which is also exploited for trade (Hilaluddin *et al.* 2006).

It does appear that the arrival of modern firearms in the hands of forest dependent communities has given way to anarchic exploitation of galliformes to cater the demand of the city and town dwellers, with game. Galliformes extraction rates are too high to sustain burgeoning wild meat demand. With the advent of modernization and cash, tribal values of conserving and protecting non-human life seem to have eroded.

The galliformes extraction data also suggests that species, specifically Hill partridge, Kalij Pheasant and Red Junglefowl are most commonly hunted in every village where they occurred. Also, people from all professions hunted galliformes equally. The age and the educational status of the hunters also did not limit their extraction quantities because most of the galliformes species are found in vicinities of human settlements and therefore are easy to trap in snares. In the surveyed villages/ localities, staple food was mainly cereal and vegetable-based and therefore consumption of wild meat probably provides a supplementary source of animal

protein. Domestic consumption of livestock is usually limited to religious and/ or matrimonial ceremonies, specifically in the western Indian Himalaya. Thus, to supplement the animal protein intake, wild meat is consumed, because it can be harvested free from the forests. By and large, hunting is rarely considered a full time profession with most practitioners does hunting in their spare time only. A majority of young people seemed to have ample spare time at their disposal, which they utilize suitably for their benefit by indulging in hunting.

The data on impact of hunting on wild populations of pheasants in the western Indian Himalaya (Hilaluddin 2006) suggests that pheasants are at risk of local extinctions from many forests patches because hunting inverted the relative contribution of species to metabolic biomasses or relative energy consumption at hunted sites. The recent most example is the local extinction of Western Tragopan from Kiri Beat under Chamba Territorial Forest Division of Himachal Pradesh. Significant declines in densities of Cheer Pheasant, Kalij Pheasant, Koklass Pheasant and Himalayan Monal pheasant in the hunted sites were recorded. However, it remained unclear whether similar or reverse trends exist in the eastern Indian Himalaya and the northeast India. Also, abundance data for most of the galliformes species are lacking for the northeast India in general and the eastern Indian Himalaya in particular and therefore it is difficult to determine the sustainability of the species offtake in this mega-biodiversity hotspot of the world. This requires immediate investigation.

There are already documented findings that forest patches subjected to hunting undergo significant changes in vegetation structure and composition due to poor pollination and seed dispersal of dependent plant species (Cullen *et al.*, 2000). This is because changes in vegetation structure and composition may have adverse affect on structure and composition of dependent animal communities as documented in birds in many forest ecosystems across the world (Thiollay, 1999; Raman and Sukumar, 2002; Skowno and Bond, 2003; Kumar and Shahabuddin, 2006). This ultimately may lead to ecological extinction of species both in marine and terrestrial ecosystems (Conner, 1998; Dayton *et al.*, 1998; Estes *et al.*, 1998; Novaro *et al.*, 2000; Redford and Feinsinger, 2001). Galliformes too are no exceptions to such consequences. However, data on how hunting may affect the population dynamics of galliformes species are sorely lacking for Asia in general, and India in particular. Further, no information exists on population and demographics of hunted versus protected sites, impact of hunting on galliformes of different age classes, impact of galliformes hunting on vegetation characteristics and demographics of plant populations in hunted versus protected sites, ecological sustainability of galliform extractions, proportion of galliformes in the diet of households and seasonal variations in galliformes harvest.



The relationship between demand for wild meat consumption and the improved economic livelihoods is also not so simple. It can not be assumed that economic development in itself will reduce demand for galliformes consumption. It could easily enhance both in the short-term and the long-term as shown by Hilaluddin *et al.* (2005a). The long-term option may not be relevant for the species that are most threatened by hunting (Abernethy *et al.* 2003), for which extinction in the next decade is the real possibility (Nelleman and Newton 2002). Hence, it is imperative that development assistance to rural communities includes limiting the natural resources use, from the perspectives of both food security and conservation.

Thus, the government needs to recognize wild meat extraction as major problem and some innovative decisions need to be taken by the government to regulate/curtail wild meat extraction for if the present trends continue, there may not be much left to conserve.

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Table 2 : Galliformes extraction rates and patterns (mean \pm S. E.) in the surveyed localities

Species		Number of birds hunted/ household/ annum						
		Arunachal Pradesh	Himachal Pradesh	Mizoram	Nagaland	North Bengal	Sikkim	Uttarakhand
Common name	Scientific name							
Black Francolin	<i>Francolinus francolinus</i>	0	0	0	0	0	0	1.28 ± 0.45
Blood Pheasant	<i>Ithaginis cruentus</i>	0	0	0	0	1.67 ± 0.06	0	0
Blyth's Tragopan	<i>Tragopan blythii</i>	0.94 ± 0.55	0	0	2.88 ± 1.53	0	0	0
Cheer Pheasant	<i>Catreus wallichi</i>	0	3.12 ± 0.84	0	0	0	0	0.17 ± 0.16
Chinese francolin	<i>Francolinus pintadeanus</i>	0	0	0	0.06 ± 0.02	0	0	0
Chukar Partridge	<i>Alectoris chukar</i>	0	8.77 ± 2.13	0	0	0	0	1.31 ± 0.63
Hill Partridge	<i>Arborophila torqueola</i>	11.03 ± 3.5	0	0.59 ± 0.52	14.9 ± 3.89	4.23 ± 0.08	0.73 ± 0.02	0.19 ± 0.1
Quail sp.		0	0	0	0.2 ± 0.1	0	0	0
Grey-peacock Pheasant	<i>Polyplectron bicalcaratum</i>	0	0	0.19 ± 0.13	0.39 ± 0.36	0	0	0
Himalayan Monal	<i>Lophophorus impejanus</i>	0	1.63 ± 0.39	0	0	0	0.67 ± 0.01	0
Indian Peafowl	<i>Pavo cristatus</i>	0	0	0	0	0	0.18 ± 0.01	0
Kaleej Pheasant	<i>Lophura leucomelanos</i>	6.63 ± 1.39	0	0.55 ± 0.17	4.99 ± 1.66	4.0 ± 0.06	2.27 ± 0.04	9.0 ± 1.17
Koklass Pheasant	<i>Pucrasia macrolopha</i>	0	7.96 ± 1.94	0	0	0	0	0.55 ± 0.23
Red Jungle fowl	<i>Gallus gallus</i>	6.32 ± 1.48	0	1.51 ± 0.39	1.92 ± 1.25	0	0.77 ± 0.02	0
Satyr Tragopan	<i>Tragopan styra</i>	0	0	0	0	1.86 ± 0.06	0.94 ± 0.03	0
Snow Cock	<i>Tetraogallus himalayensis</i>	0	0.12 ± 0.1	0	0	0	0	0
Western Tragopan	<i>Tragopan melanocephalus</i>	0	1.02 ± 0.21	0	0	0	0	0

Source : Kaul et al. 2003 & 2004; Hilaluddin et al.2005b, 2005c & 2006


Table 3 : Galliformes distribution and their hunting patterns in the Surveyed States

Species	No. of surveyed states where species present	No. of surveyed states where species hunted (%)
Blood Pheasant	1	1 (100)
Blyth's Tragopan	2	2 (100)
Cheer Pheasant	2	2 (100)
Chukar Partridge	2	2 (100)
Grey-peacock Pheasant	2	2 (100)
Indian Peafowl	1	1 (100)
Koklass Pheasant	2	2 (100)
Satyr Tragopan	2	2 (100)
Western Tragopan	1	1 (100)
Common-hill Partridge	7	6 (85.71)
Kaleej Pheasant	7	6 (85.71)
Himalayan Monal	3	2 (66.67)
Red junglefowl	7	4 (57.14)
Black francolin	2	1 (50)
Snow Cock	2	1 (50)
Chinese francolin	2	1 (50)
Jungle bush quail	7	1 (14.2)

Table 4 : Contribution of Galliformes into wild meat offtakes (mean \pm S. E.) of households in the surveyed states

State	Extraction in kg/household/annum (in the sampled areas)		Percentage
	Wildmeat	Galliformes	
Arunachal Pradesh	409.09 \pm 57.37	20.38 \pm 4.13	4.98
Himachal Pradesh	267.75 \pm 48.18	22.67 \pm 2.86	8.46
Mizoram	277.7 \pm 71.84	4.83 \pm 2.25	1.74
Nagaland	651.7 \pm 178.11	23.38 \pm 9.64	3.59
North Bengal	211.36 \pm 76.59	6.57 \pm 1.54	3.1
Sikkim	131.67 \pm 24.57	3.79 \pm 0.75	2.87
Uttarakhand	216.17 \pm 19.48	11.32 \pm 1.99	5.23

Source : Kaul et al. 2004; Hilaluddin et al. 2005a, 2005b & 2006



24.0 Translating Global Biodiversity values into local benefits: Conservation Initiatives of a Village Forest Council in Kumaon, Uttarakhand

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Introduction

The Gori river basin in Kumaon Himalaya is well known for its rich biodiversity values. Two of the 10 most valuable areas for biodiversity in the Western Himalaya identified by the Biodiversity Conservation Prioritization Project (BCPP) of WWF-India are in the Gori river-basin (Dhar 2000) and the area has also been recently designated as an Important Bird Area (IBA) (Islam and Rahmani 2004). However, this area is rapidly degrading due to over-utilization by local communities, and therefore, building of a local conservation constituency is being attempted.

Sarmoli is a village located in the northeastern corner of Kumaon, in Pithoragarh District, Uttarakhand, just over the first rise of the Greater Himalaya. Starting at about 2,300m, Sarmoli and its neighbour Shankhadhura, are the highest villages on their mountain slope, to have oak (*Quercus semecarpifolia*) forests above them, followed by subalpine birch (*Betula utilis*) - rhododendron forests, and alpine meadows and cliffs at 3,747m.

The rich oak forests above these two villages are the joint Van Panchayats (designated Village Forests) of Sarmoli and Jainti villages, and the Van Panchayat of Shankhadhura village. Above these forests is a portion of the Khali Reserve Forest, which includes the subalpine and alpine areas at the top of the ridge. The total area of these two Van Panchayats is ca. 20 km², which is home to 10 species of galliformes. These include: Satyr Tragopan *Tragopan satyra*, Himalayan Monal *Lophophorus impejanus*, Cheer Pheasant *Catreus wallichii*, Koklass Pheasant *Pucrasia macrolopha*, Kalij Pheasant *Lophura leucomelanos*, Himalayan Snowcock *Tetraogallus himalayensis*, Snow Partridge *Lerwa lerwa*, Hill Partridge *Arborophila torqueola*, Chukar Partridge *Alectoris chukar*, and Black Francolin *Francolinus francolinus*. The villages of Sarmoli and Jainti

have initiated efforts to conserve the pheasants and partridge populations in their Van Panjayat areas since 2005 (Viridi and Theophilus, 2004)

Threats to galliformes in the region

Apart from the Satyr Tragopan and the Snow Partridge, all the Galliformes listed above are fairly common and either sighted or heard within their respective altitude ranges. Hunting with guns and trapping with foot-snares is occasional, (not more than 30 birds in a busy year) and by itself does not seem to have affected populations very seriously yet. Perhaps the most serious direct threat to the galliformes comes from the depredation of brooding hens and their eggs by shepherds and their sheepdogs. The trans-humant migration of a large number of shepherds from neighbouring river basins with their sheep and goats take them past this area precisely at the time (April and May) of year that coincides with the breeding season of all of the galliformes here. If grazing sheep happen to flush a brooding hen, her eggs are immediately picked up. If the embryo is found to be too developed for humans to eat, the eggs are fed to the dogs. Sheep dogs with their keen sense of smell pick up large numbers of brooding hens and their chicks as well. The cumulative deleterious effect of all these put together, is significant.

Hunting for food and medicine

There is no commercial hunting of the galliformes in this area, and whatever is trapped or killed is to supplement food sources. The meat of the Snowcock, though not preferred for its aroma or edibility, is used in folk-medicine against rabies, and the meat of the Himalayan Monal as a cure for incontinence and for chronic and recurring fevers.



The Cheer and the Koklass are hunted rarely, as the meat is said to be rather stringy with ligament-like inedible threads, and therefore not preferred.

The Satyr Tragopan, the Hill Partridge and the Snow Partridge are known to be more vulnerable to hunters due to their behavioural predisposition. The Satyr Tragopan because of its small range of movement and its skulking behavior in preference to flight. The male Hill Partridge due to its easy-to-imitate call which it responds to so easily by approaching to repel the intruding caller, and the Snow Partridges whose reluctance to take wing and their habit of bunching so close together when alarmed, make them all the more vulnerable to a shotgun or musket-loader.

Trapping is done by means of foot-snares and nooses that are made from the hairs of a horse-tail, or from fishing line. The trapping is often done in conjunction with other activities in the forest such as wild plants collection or even during livestock grazing.

Habitat degradation and forest loss

The major threats to Galliformes in the area, and indeed the entire Gori river basin, are forest loss due to the demand for fuel wood and forest degradation. Competing and conflicting human use, some in the nature of use, and some in the scale of it, are clearly at the root of the problem. The solution too, most obviously, must lie in human agency for changing these use-patterns.

Conservation efforts undertaken by the Sarmoli-Jainti Van Panchayat

In order to create and build such human agency, through local communities as conservation constituencies as it were, the Sarmoli Jainti Van Panchayat has undertaken to place and elevate conservation concerns on the local communities agenda. The conservation of Galliformes in the area, and the consequent need to conserve their habitats, as well as the possible spin-offs thereby, are being used as the umbrella for longer-term efforts for protection and regulated use. The following processes and actions have been initiated by the Van Panchayat. Sarmoli-Jainti Van Panchayat, which is the commons of the two revenue villages of Sarmoli and Jainti, has just 10.5 hectares of forest for a population of 200 households. The neighbouring village Shankhadhura has over 88 hectares shared by just 26 households. Clearly the

forest is not enough by far, either in size or productivity, to be able to meet all the subsistence needs of 286 households, of fuel wood, fodder and leaf-litter, let alone using just the incremental growth. The community is dipping deep into the capital to meet just part of its needs. Even in such a situation, if the benefits of these commons do not accrue more widely, to a larger section of the community and on a longer-term basis, the commons arrangements are likely to collapse, as we have classically seen elsewhere. The motivation to protect and use rationally can, at this stage, only be driven by a sufficient flow of benefits concurrently, as well the prospect of incremental growth of the 'capital' (through enhanced productivity through protection and regeneration) for future generations.

It was therefore imperative for the Sarmoli-Jainti village community to strategize and plan for how they could optimize and diversify the flow of benefits, and ensure that it reached a larger number of households so that they continue to have a sufficient stake in its regulated use, its protection, and in maintaining its productivity. Also importantly, it was imperative for the community to consider how to create alternative flows of benefits that maybe indirect and non-extractive in nature. In order to do so, discussions were initiated and attempted to be broad-based at Van Panchayat meetings, on assessing the comparative advantages of location, taking stock of what the community possessed in terms of productive capacity, and to plan for what they could build upon to this end.

Through a process of dialogue spread over many months, a broad consensus was built within the participating village communities. The strategy developed included the following:

1. Action would be taken to improve the overall productivity of the village forest area, and prioritize for what the community needed most. Hay for winter fodder was the most critical requirement, and at the Van panchayat meetings it was planned to clear some areas adjoining the present grass stands, where seral vegetation such as *Neolitsea pallens* and thorn scrub such as *Berberis aristata*, *Princepia utilis* and *Cretaeagus crenulata* have taken over.
2. The Sarmoli-Jainti Panchayat forest is located close to the Munsiri bazaar, which is receiving a rapidly increasing tourist traffic. Due to this proximity however, the Sarmoli-Jainti community is in a position to attract reasonable volumes of nature tourist traffic to visit their village forest and the adjoining Reserve Forest. Ensuring that such tourism remains community-based, can also ensure earnings to



many households through home-stay facilities, and possible employment to several unemployed youth through opportunities to guide and handle logistics for nature travelers.

3. In order for the village forests to remain attractive to such visitors, the community would need to not only conserve as much of the originality (including spectacular old-growth of grand oaks and yew trees) and beauty of their village forest, but also the more easy to spot and spectacular wildlife, such as the abundant galliformes that still exist there.

4. It was also resolved to seek collaborative assistance and cooperation from the World Pheasant Association (WPA)-India, as well as the Ministry of Environment and Forests (MoEF) and the Uttarakhand State Forest Department, both for finance, as well as synergistic action.

Actions initiated

A Project Proposal was developed in collaboration with WPA-India, and proposed to the MoEF. A three year Project was approved during 2006, with financial assistance for efforts on protection, watch and ward, environmental education, and capacity enhancement. The project is currently ongoing.

Research

1. A population and distribution survey was conducted for the Satyr Tragopan and the Koklass Pheasant in the Khalia range in April 2006, and a survey to gauge seasonal movements of all the species of Galliformes present was undertaken during the winter of 2006-2007, and local youth trained on the job in some basic research techniques.

2. In order to generate primary data on the scale of anthropogenic depredation, and on the nature and seasonality of overlapping habitat-use by humans, their livestock, and by galliformes, a survey of the monsoon encampments for livestock and transhumant pastoralism was undertaken through August and September 2006. Forest clearance and degradation of habitats through livestock grazing is a major factor. The intensity of grazing and disturbance was quantified through data collection on the presence of livestock in the project area during the summer and monsoon months. This included seasonal buffalo encampments, pasturing of bullocks and cows, as well as

staging of transhumant herds of goats and sheep in the area.

Conservation actions

3. The hunting and trapping of galliformes within the Van Panchayat was disallowed. Broad community consensus on this has been attempted to be built through resolutions in General Body Meetings, as well as through Oath Taking Ceremonies by the youth in the community.

4. A Nature Interpretation Centre was established in a room rented by the Project in Sarmoli Village. The centre is building up its displays and resources gradually, and presently has literature on galliformes conservation efforts in Himachal Pradesh, and in Pakistan and Sri Lanka, and other related literature. The Centre is being developed as an interpretation centre for locals as well as tourist. It also serves as a meeting space for our and neighbouring Van Panchayat- all this to give a greater visibility to the projects conservation objectives.

5. Plantation activities were undertaken, with special emphasis on the re-vegetation of the species that are a critical part of the habitat for the pheasant species that inhabit the project area. Among plants, the one that is most clearly linked to Tragopan and Monal habitat is the *ringal* or montane bamboo (*Chimnobambusa jaunsarensis*). It is a monopodial species found mostly in moist gulleys and steep forested mountain slopes at altitudes ranging from 2,100 to 3,300m. It is a clearly associated species in the preferred habitat range of the Satyr Tragopan and is known by local hunters to constitute a significant portion of its winter forage, as well as that of the Monal pheasant, the Himalayan Musk deer and Serow. Through the month of July 2006, re-vegetation of *Chimnobambusa jaunsarensis* bamboo runners along moist gullies was undertaken to provide the dense understorey habitats.

6. The lopping and felling of *Quercus semecarpifolia* trees for forage, and for subsistence fuelwood use and sale to the growing local market is leading to a severe pressure on this species. Besides this, the cutting of fresh *Quercus semecarpifolia* oak-leaves for fodder from the larger trees by goat herders from the village is affecting the roosting sites known to be used by pheasants. Apart from putting certain trees under protection from lopping, the Van Panchayat also undertook intensive seeding of 36.5 kgs of *Quercus* acorns through voluntary labour from the community.



7. Only very small-scale clearance of thorn-scrub seral vegetation was undertaken, and in a rational and premeditated manner, providing for sufficient patches to be left untouched where presently pheasants and partridges reside, and proper corridors of such protective vegetation between patches, importantly along moist gulleys.

8. Following the cutting of grass for winter fodder from the Van Panchayat in October, it is a common practice to set fire to the grasslands to suppress seral regeneration. This practice has been challenged as it leads to severe destruction of habitat of species that inhabit the forests and grasslands. It is also during this period in November and December that protection and patrolling activities were intensified, and fires subdued.

9. The Van Panchayat has also succeeded in rejuvenating a major section an old and beautiful water body- Mesar kund, within the Van Panchayat area. Apart from recharging subterranean flows, and later springs and seepages, the Van Panchayat is developing this site as a tourist destination to tie in with their CBT programme, under which there are presently 22 families that provide Bed-and-Breakfast to visiting tourists.

Livelihoods enhancement

10. A first batch of 10 young men were identified and sent for a basic rock-climbing course at the Nainital Mountaineering Club. Two from among these were sent to the Nehru Institute for Mountaineering in Uttarakashi for a certified Mountaineering Course, so as to upgrade their skills further, and make them more employable as nature and adventure guides.

11. A full time Forest Watcher has been employed with part assistance from the Project. This enables not only year-round protection for the vegetation in the village forest, but also to all fauna, the galliformes in particular, in the hunting season.

12. Earnings to individual households in the village who undertook to keep tourists in their homes under the community based Home-Stay programme of the Sarmoli-Jainti Van Panchayat earned a total of Rs. 80,000 during the year, while young men employed as porters and guides earned Rs. 40,000. Pack animal operators from the village

earned Rs. 30,000 for carriage organized by the Van Panchayat for tourists. The Van Panchayat itself earned Rs. 10,000 from hiring out camping equipment and from handling the logistics of some large trekking groups. These earnings in the first year have helped the Van Panchayat demonstrate to its own community that alternative and non-extractive use of our village forest and adjoining landscapes can bring incomes to many in the village.

Discussion

While there is an increasing proportion of the village community who now see more clearly why conserving galliformes and their habitats, whether within their village forest or in the adjoining Reserve Forest, is worthy of their investment in restraint, as well as their positive energies, there are many miles to go. The major aspects that will be required to be worked on are as under:

1. Manifest and consistent cooperation from the State ~~Forest Department~~ *as an equal partner* in the effort. In this case the cooperation of the Forest Department is critical because the Khalia Compartment constitutes the largest and the most critical part of the habitat configuration, in combination with the adjoining Van Panchayats of Sarmoli-Jainti and Shankhadhura. A political and cultural shift is required at the ground level, from the Forest Department having long been a police force for the State, to a partner of local communities in their conservation efforts. While the language to this effect is present in proclaimed policy, there is a serious lag in legal frameworks, organizational structures, as well as the way relations with local communities are structured and maintained on a day-to-day basis. The communities themselves need to grow out of the power structures and alienation of the patron-client relationship, in order that protection plans and efforts by communities get a strong *locus standi* in the the Khalia RF Blocks as well. This is still a challenge.

2. The kind of resources and assistance required for such broad-based changes, as well as for the systematic and technically adequate data that requires to be collected, especially at the galliformes population-dynamics level are inadequately committed to so far. Three year project time-frames are also woefully inadequate. This effort is, in a sense, path-breaking, and longer-term support will be required, both financially as well as in aspects of base-line and ongoing research.



3. Nine villages with a total human population of about 4,700 have use-rights in the Khalia RF Compartment. Some of these villages are close and use these forests more intensively for their diverse needs, while others are further and only graze their livestock seasonally. A broad consensus, as well as a manifest system of self-regulation will need to be worked out with all the nine villages as well, or adherence to regulation only by a few villages in the face of free-riding by others, could lead to the collapse of any mechanisms in place. Though steps in this direction have been initiated through the Munsairi Van Panchayat Sangathan or the Forum for Village Forest Councils of Munsairi, wherein the need for concerted action has been discussed and emphasised, the pressures are so great that it will still require much greater investment of effort and time.

4. Broad basing benefit flows from the forests in the form of generating alternative employment like nature based tourism has served as an effective tool to promote conservation efforts of both the habitat and the galliformes themselves. The link between the two has been made conditional and central to availing of these benefits.

Conditions are not ideal, and it is clear that cultural shifts and institutional mechanisms do take time to establish themselves. For the sake of the very biodiverse and valuable ecosystems that the galliformes inhabit and are a part of, efforts at building conservation constituencies within local communities, even through the instrumentation of natural resource based

livelihoods, must be initiated on the ground and taken forward. This is one such attempt.

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25.0 Impact of the Indian Peafowl (*Pavo cristatus*) on Agricultural ecosystems

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Introduction

The Indian Peafowl (*Pavo cristatus*) is a granivorous bird and feeds on grains and seeds, which are of economic importance, thereby coming into direct conflict with man for a limited and valuable commodity. This may result into conflicts with our economic interests and could pose multifarious problems. The Indian Peafowl is often labeled as 'agricultural pest' and if their impact on agricultural crop is adverse then their population may have to face retaliatory killings by local villagers or management actions by the State Forest and Wildlife Departments. It is well known that the agro-pestiferous role of birds is of great concern in a developing country such as India where the economy is dependent primarily on agricultural production and any factor(s) that brings about reduction in the former has to be viewed seriously and warrants appropriate action. This has rendered it necessary to evolve a safe and practical method of crop protection from birds. At the same time one should not ignore the fact that the peafowl is also beneficial to agriculture because they destroy number of insect pests.

Management of wildlife damage

The need for controlling wildlife damage will increase when agriculturist's profit margins decreases. Kendeigh and Pinowski (1972) have reported that granivorous birds are of world wide occurrence and that they are a component of man made ecosystems because of their association with man's main food crops. The management of bird pests had been one of the difficult areas to tackle due to the highly intelligent, adaptable and mobile nature of birds and above all, the need to preserve the ecological balance. Crop damage by the Indian Peafowl is one of the significant managerial obstacles for wildlife managers. Such problems can be tackled by adopting appropriate non-invasive control methods. There is no comprehensive account of peafowl crop damage in India, which could be utilized for damage assessment and management with the exception of work carried out in Tamil Nadu by Sathyanarayana (1999-2002).

Crop damage by the Indian Peafowl

In Tamil Nadu, the Indian Peafowl preferred primarily paddy as their bulk food and secondarily the finger millet (*ragi*), and then the pearl millet (*sorghum*) (Sathyanarayana, 2004). The over all results show that the peafowl consumed 0.99 gms/ m² area/day. The observations on the intact and damaged tillers shows that 1.9% paddy tillers/m² day were damaged by the peafowl. The preference for paddy may be due to the fact that there seems to be an innate preference for grains having elongated rather than round forms and also the paddy was highly preferred crop of this region. The larger (unbroken) grains are preferred over small grain fragments.

The farmers who raise paddy, maize and groundnut in the area, admit that the birds cause damage to their crops by eating the grains and by the train feathers while moving about in the fields. But the farmers have not taken it as seriously, and often appointed boys to chase these birds away gently. The farmers agree that they are ready to give a small portion of their produce to these birds. The Hindu mythology had given an exalted status for the Indian Peafowl by associating it with Lord Muruga and the same has helped their protection by local people. However, these poor farmers may not be in a position to accept the crop damage by the peafowl if it increases to higher levels. Therefore, increased incidence of crop damage by Indian Peafowl in the agricultural landscapes is likely to develop antagonistic attitude of the farmers. Ali and Ripley (1983) have reported that in areas where the peafowl is semi feral and abundant, it is highly destructive to cereal and ground nut crops.

Peafowl mortalities due to consumption of pesticide treated seeds have been reported in several parts of the Tamil Nadu and also elsewhere in India, in the recent past. The farmers need to be educated about the damage of such high doses of pesticides to peafowl and also advised to use appropriate technique to minimize the crop damage by birds. The better technique available for minimizing the crop damage by peafowl is 'Reflective ribbon' or 'bird scaring tape devise'.



Suggested Mitigation – Use of Reflective Ribbons

The All India Coordinated Research Project on Agricultural Ornithology [AICRP] has developed certain bird scaring devices and recommended the same to the farmers for protecting their crops from bird damage during its vulnerable period. Reflective ribbon or bird scaring ribbon could be used to scare the birds from crops such as sunflower, jowar, bajra, maize, guava, grapes and fish ponds. The technique of bird scaring by reflective ribbons is one of the eco-friendly bird management methods. This device is easily adaptable by the farmers in the field for scaring the birds.

Reflective ribbon is a polypropylene metallic shining with red one side and silver white on other side and is prepared by cutting into strips of 10 or 15 m length and 1.5 cm width. About 25-30 such strips are fixed in an acre with the help of bamboo poles keeping just one foot above the crop level and slightly twisted to reflect the sunlight throughout the day. The inter distance between the two should be about 5 to 8 m depending upon the crop size and pest population. During sunshine, the brightness to the bird and humming noise produced in the wind scares the bird from the field.

The use of Reflective Ribbon in crop fields has helped in preventing crop damage by peafowl. It was found that the peafowl avoided crop fields such as paddy /ground nut/

onion/ and ladies finger, where the reflective ribbons were fixed. These farmer friendly ribbons are safe and harmless to the peafowl. This ribbon is also used to prevent the entry of parakeets and other birds. The farmers have started using the Reflective Ribbon in some parts of the Tamil Nadu, which needs to be encouraged and replicated in areas of the Indian Peafowl distribution range in India, where crop damage has been reported.

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26.0 Techniques for Monitoring Galliformes in India

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Introduction

Galliformes form an important component of the wildlife diversity in India and are well represented by Pheasants, Partridges, Quails, Francolins, Snowcocks and Megapode. They occur in a wide variety of habitats ranging from the hot and arid deserts of western India to the cold and wet high altitude forests in the Eastern Himalaya and northeast hills; and from the cold deserts in the north to the dry coastal plains in Peninsular India and the Islands. Many of the Galliformes are endangered or threatened due to poaching for meat/feathers, habitat degradation and habitat loss due to changing land use practices. They form a significant prey base for a variety of predators that includes large and small mammalian carnivores, raptors, and reptiles. They are good indicators of habitat quality as they depend substantially on ground layer vegetation for food and cover requirements, and water. The pheasants of India have been an integral part of humans for centuries as they are well recognized for their aesthetic, socio-cultural and religious values.

Long-term conservation of these galliformes, pheasants in particular, is of high priority for many states. In order to conserve and manage any wildlife species, basic information on its distribution, population, habitat use and behaviour are crucial.

Estimating distribution, abundance and monitoring of galliformes in India has been a difficult task due to the following reasons: (i) some of the galliformes inhabit dense, rugged and remote high altitude regions or dense forests with thick undergrowth; (ii) most of the galliformes are shy and cannot be observed easily due to their skulking or flushing behaviour (iii) All of them have specific habitat preferences that vary seasonally; and (iv) some of them occur in very low densities in nature.

Nevertheless, monitoring of galliformes is extremely crucial and to begin with information on presence / absence needs

to be collected. After establishment of this information, relative abundance and monitoring of galliformes could be carried out. As galliformes are widely distributed throughout the country we require simple techniques for monitoring galliformes that could be used by field staff of forest and wildlife departments, amateur bird watchers, and other civil society members.

For estimating distribution, abundance and monitoring of galliformes in India, the following methods are proposed.

Presence/ Absence Mapping

Information on the presence/absence of a galliforme species could be recorded for a sampling unit of a given area (Rodgers (1991)). The forest and wildlife staff could record presence/absence of the different galliformes at the compartment or beat levels in a Forest Range of a Reserved Forest or Protected Area (PA). In case of non availability of compartment based maps, the area could be divided into grids or into small units based on natural features and information on presence/absence recorded. Similarly, for areas that are outside the PA network or Forest Divisions, one could record presence/absence of galliforme species at village, panchayat, gramsabha, blocks, taluks and district levels. Information on the presence/absence of Galliformes in defense land areas, institutional campuses and other private lands areas could be gathered by dividing such areas into small sampling units or grids. Details such as the name and exact location of the sites/localities where presence/absence of pheasants is being recorded should be maintained. The GPS location, altitude range and general forest or habitat types should also be recorded.

Confirmation of the presence of a galliformes species could be based on direct sightings or evidences such as feathers or calls and reliable secondary information based on



published information, departmental records and interviews with local people. The status of each species in each compartment or grid has to be assessed and recorded. Qualitative assessment could be: absent, very rare, rare, common, fairly common, abundant, but one should define the categories. For example, rare = 1 or 2 individuals seen occasionally; common = 5 or 6 individuals seen in 1 or 2 days of field work; abundant = over 10 individuals seen in one day's field work. It would be important to give information on the extent of the area surveyed. The assessment of the status could be based on field surveys or through reliable secondary information (from local villagers).

Encounter Rates

Encounter Rate (ER) is a simple index for abundance estimation and is expressed as number seen per unit effort. The unit effort could be time spent in intensively searching for animals in an area or it could be the distance traveled in an area intensively searching for animals. Number seen could be based on direct evidences (sightings) or indirect evidences such as calls, droppings and other signs such as digging signs for feeding. Gaston *et al.* (1981), Gaston & Garson (1992); Bibby *et al.* (1992), Sathyakumar *et al.* (1993), Ramesh *et al.* (1999), Ramesh (2003) Sathyakumar (2004, 2006), and Bhattacharya *et al.* (2007) have used ER for monitoring galliformes.

One could survey an area for galliformes by walking along existing roads, paths, trails, ridges, *nullahs* or along a predetermined bearing using a compass or GPS. Driving along roads is another way for surveying for galliformes in an area. If the distance traveled is measured, then one could use that as effort (ER = number seen/km walked). In cases when distance traveled is not known, one could use the time spent in searching that area as effort (ER = number seen/time spent). For example, if a person walked 2 km and sighted 4 Grey Francolin, then $ER = 4/2$, i.e., 2 Grey Francolins/km walk. Similarly, if a person spent 2 hours in a forest area intensively searching for pheasants and sighted 1 Tragopan, then $ER = 0.5$ tragopan/hour search. Indirect evidences such as calls and droppings could also be used, but one should be very careful in identification of calls of different species and calls of different individuals of the same species. Similarly, care should be taken to identify dropping or other signs of a species. For example, 2 Black Francolin calls heard/km walk; 4 peafowl droppings/km walk.

Encounter Rates are good for monitoring the abundance of galliformes in an area, if done regularly (monthly/ seasonally/ annually). Comparison of ER of a species in two similar habitats located in different areas could be made. Adequate number of walks per month or season is necessary for

calculating mean ER and standard errors. This technique is applicable for most of the galliformes.

Line Transects

Line transect (Burnham *et al.* 1980) is a simple, easy to execute method that can help in obtaining density estimate for galliformes in area. In this method, one walks along a straight line and counts animals on both sides of the line. Line transect could be permanently marked and vegetation trimmed for the observer to walk easily and carefully look for animals. In case of temporary transects, the observer walks in a straight line using a compass on a predetermined bearing. At least 2 or 3 transects of length ranging between 1 and 3 km to be laid each habitat/area and walked at least 2 or 3 times in a month during the early morning hours. For every sighting, species, number, age and sex (if possible), sighting angle and sighting distance are measured. This information will be useful in calculating the ER and Density of pheasants in an area. This technique is best suited for pheasants such as monal, Kalij, Red Junglefowl, Grey Junglefowl and the Indian Peafowl Sathyakumar *et al.* (1993), Sathyakumar (2004, 2006). Software such as Distance (Laake *et al.* 1993) could be used to analyse line transect data for obtaining ER and density estimates.

Call Counts

The abundance of some pheasants that have gregarious calling behaviour during breeding season could be estimated by using Call Count Technique (Gaston 1980, Rodgers, 1988, Kaul 1989, Ramesh *et al.* 1999; Ramesh 2003). During breeding season (April-May), males call during early morning hours (predawn period) to attract females and also to challenge rival males in the vicinity. In this method, one or two observers placed at least 500m apart along a line in a pheasant habitat count calls during predawn. This is an index of the number of calling males in an area and the call count is expressed as number of calling males / station. In ideal situation, every calling male would have a female. But in some cases, a calling male may not have a female or a calling male may have a female with juveniles also. No call heard in an area does not necessarily mean that there are no birds in that area. One can playback a call in an area to get response from individuals in that area. Call count method is good for monitoring populations of calling males in an area over years. Additional information on the group sizes during the breeding seasons will help in understanding the population size in an area. This method is best suited for Tragopans, Koklass and Cheer.

Sample Data sheets for Monitoring of Pheasants are placed as Appendix I, II & III.



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Appendix - I

MONITORING OF PHEASANTS
Data Sheet No. 1: Presence/absence survey

Year: ----- Month: ----- Date: ----- Name(s) of observer/recorder: -----	Name of Forest Division/Protected Area: ----- Name of Range: ----- Name of Beat: ----- Area of Beat: -----
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Compartment No. or Area Name	Presence /Absence of Galliformes Species						Remarks
	Indian Peafowl	Red Junglefowl	Kalij Pheasant	Koklass Pheasant	Himalayan Monal	Western Tragopan	Cheer Pheasant

- Write '1' if the bird was SIGHTED or CALLS HEARD (with certainty) or if found any other evidences (e.g. feathers) during the survey. It is to provide personal confirmation of bird presence in the beat/compartment during the survey period. Indicate in the Remarks column if the confirmation is based on only calls or other evidences.
- Write '0' if there was NO sighting or call or any other sign of bird occurrence during the survey. It is to provide personal confirmation of bird absence in the beat/compartment during the survey.
- In the absence of any sign during the survey, but, if the observer believed the presence of any pheasants from his/her personal experience (sighted or heard recently during regular visit to the area) or by reliable information passed on to him/her by his colleagues or local people, write 'ID'. Indicate in the Remarks column the approximate time (e.g. within 3 months or before) when the bird was last sighted or heard by him/her or colleagues or local people.

Name of Survey Trail/Route: _____ Name of Start Point: _____ Start Time: _____
 Approximate distance (km): _____ Name of End Point: _____ End Time: _____

[illegible]



Appendix – III

Data Sheet No. 3: CALL COUNTS FOR PHEASANTS

Year:

Month:

Date:

Name(s) of observer/ recorder:

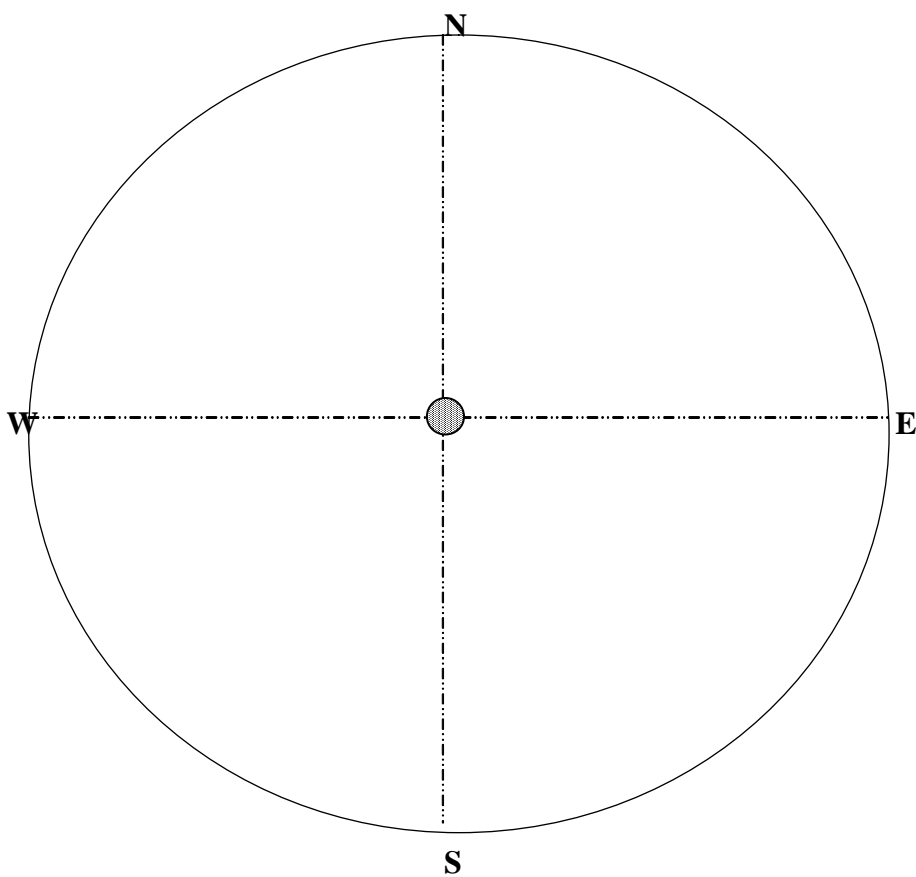
Name of Forest Division/ Protected Area:

Name of Range:

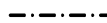
Name of Beat: Area of Beat:

Name of call count point:

Start time: End Time:



Observer



Approx.

27.0 Protocol for Monitoring Megapode and its Habitats

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The mound nesting Nicobar megapode is endemic to the Nicobar group of islands. As mounds are stationary, inanimate and represent breeding, the best way to estimate and monitor the megapode populations is by counting mounds (Sankaran, 1995; Sivakumar, 2000; Sivakumar and Sankaran, 2003). The methods adopted for monitoring megapode in Nicobar Islands is presented below.

The coastline of 15 islands where the species is present was surveyed for mounds after tsunami and 38 transects (sites) were identified for long-term monitoring of this species. Detailed information about transects locations, habitat, mound presence and other details are available in Sivakumar (2007). Average length of these transects was 2 km, however, in some cases, the length of transects were small due to smaller size of islands. All the mounds along transects were counted. The width of transect was from the sea shore up to the end of the low-lying forests or 300m distance whichever is less. Data on total number of active mounds, abandoned mounds, mound size (circumference and height), number of pits present in a mound, and the distance between high tide mark and mound was collected by walking along the transect. Parameters such as plantation, fire, logging, wood cutting, evidence for hunting and invasion of weeds in the transect area were also recorded. The data sheet that was used to record the information from the field

(Data sheet I) could be made available to the field staff by the State Forest Department especially in the Office of the Divisional Forest Officer, Campbell Bay, Great Nicobar.

Active mounds in use can be identified by signs of recent digging by megapodes or by checking the mound whether the soil is compact and hard with vegetation growth over it (abandoned mound) or loose and easily penetrable with a stick (active mound).

A total of 111 active mounds observed from 38 transects have been identified for permanent monitoring (Sivakumar, 2007 also see Annexure I), which is 65.68% of the total active mounds observed from all transects surveyed in 2006. Hence, it is believed that any major changes in the abundance of active mounds from these permanent transects would directly reflect the total population of mounds as well as megapodes.

Monitoring the megapodes from permanent transects will give an idea about the trends in the population and changes in the habitat, but not the actual size of the population. For estimating the total coastal population of megapodes, a total survey of mounds in all transects identified in Annexure I at five years interval is highly recommended.

Table 1 : Details of mounts along permanent transects.

Island	No. of permanent transects (PT)	Active mounds observed in PT in 2006	Abandoned mounds observed in PT in 2006	Proportion of abandoned mounds
Great Nicobar	11	46	12	0.26
Kondul	1	1	0	0.00
Little Nicobar	4	15	6	0.40
Menchal	1	3	1	0.33
Meroe	1	2	1	0.50
Pilo Milo	1	0	0	
Trax	1	3	1	0.33
Treis	3	3	0	0.00
Nancowry	3	3	0	0.00
Katchal	2	2	0	0.00
Camorta	3	3	2	0.67
Tillanchang	3	9	5	0.56
Trinket	2	10	0	0.00
Teressa	4	6	0	0.00
Bampoka	1	5	1	0.20

[illegible]



Annexure I : Details of transects surveyed in the potential coastal habitat in 2007 and the location of permanent transects for the continuous monitoring of the Nicobar megapode population.

S.No	Island	Place	Total Length (km)	Active Mounds	Abandoned	Inactive	Substratum	Megapode sighting	GPS N	GPS E	Direction from GPS location	Transect for Permanent monitoring
1	Great Nicobar	Trinket Bay	2	5	0	0	Sandy	Yes	71247.7	935103.2	North	Y
2	Great Nicobar	South Trinket	2	4	1	1	Sandy-loam	Yes	71305.5	935208.5	North	
3	Great Nicobar	Lawful North	2	4	1	1	Sandy-loam	Yes	71143.7	935255.9	North	
4	Great Nicobar	lawful	2	8	4	1	Sandy-loam	Yes	71018.1	935242.8	North	Y
5	Great Nicobar	North Dungi nala	2	3	1	0	Sandy	No	70352.9	935419.1	North	
6	Great Nicobar	Navy Dera South	2	1	0	0	Sandy-loam	No	70438.5	935341	North	
7	Great Nicobar	Navy Dera	2	2	2	1	Sandy	Yes	70814.4	935306.8	North	Y
8	Great Nicobar	Chodi nala	2	5	4	3	Loamy	Yes	70726.7	935314.8	North	Y
9	Great Nicobar	Ganges creek	2	0	0	0	Clay	No	71405.9	934951.5	West	Y
10	Great Nicobar	Indira point	2	0	0	0	Sandy	No	64525.2	934936.1	North	
11	Great Nicobar	Megapode camp	2	2	0	0	Clay	No	64552.1	935010.7	North	Y
12	Great Nicobar	Binfen	2	0	0	0	Sandy	No	64811.7	935247.1	South	
13	Great Nicobar	Pulo Bhabi	2	4	1	0	Sandy	No	65402.4	934613.3	South	Y
14	Great Nicobar	Kosindon	4.5	10	1	0	Sandy	Yes	65616.8	934508.8	North	Y
15	Great Nicobar	Alexandria	2	3	0	0	Sandy	No	65851.8	934358.9	North	
16	Great Nicobar	Pulo Kunj	2	1	0	0	Sandy	No	70148.9	934016.8	South	
17	Great Nicobar	Pilo Bakka	2	2	0	0	Sandy-loam	No	64941.1	934735.8	South	Y
18	Great Nicobar	Pulo Bed	2	2	0	0	Sandy	No	70352.1	934010.6	South	
19	Great Nicobar	Rekoret	2	6	0	0	Sandy	No	70810.5	934021.2	South	Y
20	Great Nicobar	Habra Bay	2	2	0	0	Sandy	No	71119.3	934220.1	West	Y
21	Kondul	Kondul	1	1	0	0	Sandy	Yes	71231.8	934307.9	North	Y
22	Little Nicobar	Pulo Patia	2	2	1	0	Loamy	Yes	71918.5	934341.6	North	
23	Little Nicobar	North Patia	1.5	6	1	1	Sandy	Yes	72121.2	934511.6	North	Y



S.No	Island	Place	Total Length (km)	Active Mounds	Abandoned	Inactive	Substratum	Megapode sighting	GPS N	GPSE	Direction from GPS location	Transect for Permanent monitoring
24	Little Nicobar	Pulo Panja	2	2	2	1	Sandy-loam	Yes	72256.1	934437.1	North	
25	Little Nicobar	School Point	2	1	3	0	Loamy	No	72339.4	934333.2	North	Y
26	Little Nicobar	Minlana	3	5	2	1	Clay-Loam	No	72505.9	934236.1	South	Y
27	Little Nicobar	Pulo Kiyang	1.5	0	1	0	Sandy-loam	No	71504	933827.8	South	
28	Little Nicobar	Muhincopin	2	4	0	0	Sandy-loam	No	71812.6	933748.2	South	
29	Little Nicobar	Bahua	2	2	0	0	Sandy	No	71933.7	933817.4	North	
30	Little Nicobar	Enfok	1.5	3	0	0	Sandy	No	72217.7	933829.9	West	Y
31	Menchal	Men	0.5	3	1	0	Loamy	No	72343	934554.2	North	Y
32	Meroe	Meroe	2	2	1	0	Sandy	No	73257.1	932450.4	South	Y
33	Pilo Milo	Pilo Milo	1.5	0	1	0	Clay	No	72402.3	934134.1	North	
34	Trak	Trak (NCHM)	<1	0	0	0	Sandy	No	72839.1	933755.5	South	Y
35	Treis	Treis	2	3	1	0	Sandy	No	72831.5	933852.8	North	Y
36	Nancowry	North to Tapang	2	0	0	0	Sandy	No	80044.4	933411.7	North	Y
37	Nancowry	Tapang	2	0	0	0	Sandy	No	75913.5	933448.1	North	
38	Nancowry	Connaught Bay	2	3	0	0	Sandy	Yes	75605	933446.1	North	Y
39	Nancowry	North to Cape Connaught	2	1	1	0	Sandy-loam	No	75627	933342.6	North	
41	Nancowry	South to Hindrah	2	1	0	0	Sandy-loam	No	75716.1	933243.6	North	
42	Nancowry	South to Lapat	2	0	0	0	Sandy-loam	No	75847.5	933058.3	North	Y
43	Nancowry	North Lapat	2	2	0	0	Sandy	No	75918.7	933032.3	North	
44	Nancowry	Chinla	2	0	0	0	Sandy-loam	No	75947.5	933310	West	
45	Katchal	South Point	2	2	0	0	Loamy	No	75508	932753.7	South	Y
46	Katchal	South to Kallatopaini	2	0	0	0	Sandy-loam	No	75541.4	932742	South	
47	Katchal	East Bay	2	0	1	0	Sandy-loam	No	75736	932527.7	South	
48	Katchal	Yuns Yenku	2	0	0	0	Sandy-loam	No	75313	932157.2	North	Y



S.No	Island	Place	Total Length (km)	Active Mounds	Abandoned	Inactive	Substratum	Megapode sighting	GPS N	GPS E	Direction from GPS location	Transect for Permanent monitoring
49	Katchal		2	0	0	0	Sandy	No	80034.8	932423.2	North	
50	Katchal	South to Julia	2	2	0	0	Sandy	No	80120.8	932301.9	West	
51	Katchal	Julia	2	0	0	0	Sandy	No	80034.7	932122.7	East	
52	Camorta	Near Pullaw (Expedition harbour)	2	0	0	0	Sandy	No	80427.2	933030.2	South	
53	Camorta	Dring	2	1	1	0	Loamy	Yes	80618.4	932929.8	South	Y
54	Camorta	South to Dring Harbour	2	1	1	0	Clay	No	80445.5	932903.6	South	
55	Camorta	North to Itiya Harbour	2	0	0	0	Clay	No	81038.6	932740.6	South	
56	Camorta	Ronyok	2	1	1	0	Sandy-loam	No	80812.8	932741.9	South	Y
57	Camorta	Ol Hinpun	2	0	0	0	Sandy	No	80953.8	932723.7	South	
58	Camorta	Nighreak	2	0	0	0	Sandy	No	81157.7	932938.8	South	
59	Camorta	Bada Eneka	2	0	1	0	Clay	No	80447.6	933244.1	North	
60	Camorta	Kakana	2	0	0	0	Sandy	No	81005.6	933133.3	North	
61	Camorta	Kakana North (Interior)	1	1	0	0	Loamy	No	81235.5	933222	North	Y
62	Camorta	Kakana North coastal	2	0	0	0	Sandy	No	81139.5	933232.1	North	
63	Tillanchang	Castle bay	1	2	1	0	Sandy	Yes	82634.8	933823.9	North	Y
64	Tillanchang	South to Cape Mand	2	3	1	0	Sandy	No	83215.3	933757.7	South	Y
65	Tillanchang	Near Maharani Peak	2	3	2	0	Sandy-loam	No	83042.4	933841.9	South	
66	Tillanchang	Noth cheela	2	4	3	0	Sandy	No	82925.4	933745.8	North	
67	Tillanchang	Cape Winifred	2	4	3	0	Sandy	No	82624.9	933712.8	South	Y
68	Trinket	Piyang	2	4	0	0	Sandy	No	80513.8	933522.5	South	
69	Trinket	Muk Kang	1.5	3	0	0	Sandy	No	80346.5	933529.8	South	
70	Trinket	Safed Balu	2	1	0	0	Sandy-loam	No	80712.5	933554.4	East	



S.No	Island	Place	Total Length (km)	Active Mounds	Abandoned	Inactive	Substratum	Megapode sighting	GPS N	GPS E	Direction from GPS location	Transect for Permanent monitoring
71	Trinket	Trinket (Laful)	2	2	0	0	Sandy	No	80338.3	933432.5	North	Y
72	Trinket	Trinket	2	2	0	0	Sandy-loam	No	80455.8	933500.5	North	
73	Trinket	Near Light House	2	8	0	0	Sandy	Yes	80303.5	933458.1	South	Y
74	Teresa	North to Bangala	4	1	0	0	Sandy-loam	Yes	81854.5	930754.1	North	Y
75	Teresa	Alurang	2	2	0	0	Sandy-loam	No	81944.3	930548.5	North	Y
76	Teresa	Hiram	2	0	0	0	Sandy	No	81534.3	930546.1	South	
77	Teresa	Minyuk	2	0	0	0	Sandy	No	81528.6	930813.6	South	Y
78	Teresa	Laksi	2	0	0	0	Sandy	No	81219.4	930934.1	North	
79	Teresa	Kolaru	2	1	0	0	Sandy	No	81328.4	931108.1	South	
80	Teresa	Rakraka	2	3	0	0	Sandy	No	81206.4	931209.8	West	Y
81	Bampoka	Poakat	2	5	1	0	Sandy	No	81432.9	931325.9	North	Y

27.0 Techniques for Live Capture and Radio-telemetry of Galliformes

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Introduction

Live captures of animals are required for a wide range of purposes in wildlife research and conservation. Most commonly, individuals are captured for application of telemetry to quantify habitat use, survival, migration and behaviour (White and Garrott 1990; Aebischer *et al.* 1993; Powell *et al.* 2000; Javed *et al.* 2003; Cooke *et al.* 2004; Kalsi and Rana 2004; Rana and Kalsi 2004; Kalsi 2005), and for population estimation using capture-recapture framework and other methods (Otis *et al.* 1978; Nichols 1992; Buckland *et al.* 2006). Capture is also necessary for conservation breeding projects, transporting animals between captive breeding centers, zoos and for release or reintroduction into the wild habitats. Typically, live capture is an arduous undertaking and more so in the wild, especially of rare animals and that are elusive and shy. It is critical that the capture induces only negligible risk to physical and psychological states of the animals. Besides ethical and legal consequences, any mortality or negative impact on the animal would only make the capture redundant or weaken the utility for which it was captured (Calvo and Furness 1992). Therefore, successful capture essentially relates to meticulous design, effective trap and professional execution which include appropriate handling protocol. Simultaneously, a basic understanding on the distribution, movement and physiology of target individuals would likely enhance the trapping opportunities and success. Through innovations and experimentations, there are now several trapping techniques available for different groups of birds and for specific conditions (Bub 1991). Indigenous methods used by forest dwelling people have also contributed to the design and development of some of these techniques.

Use of telemetry doubtless scripted a revolutionary step in wildlife research, for its ability to gather finer details of almost every aspect of a species, overcoming methodological constraints faced earlier. Human-wildlife conflict could be better understood and suggestions towards scientific management received greater credibility and acceptance. Disease related investigations involve telemetry, as there is a need for comparative knowledge of movement and activity

of infested and healthy animals (Houseknecht 1970). Telemetry is often the only way of collecting quality data on evasive species and those are difficult to be monitored by visual encounter or through conspicuous tags or visible markers (Kenward 2001). It is also remarkable in saving human life particularly of dementia patients, helping memory impaired people to track their way through (McShane *et al.* 1998) and in preventing vehicular accidents and unlawful activities. However, application of telemetry in wildlife studies is not without limitations and most often, the decision to use this tool is driven by (a) the real necessity after considering other options, (b) affordability of finance, people and time, (c) ability to capture required number of target individuals, and (d) more importantly, the efficiency of tagging and subsequent monitoring (Kenward 2001). Since inception in late 1950s, ecological investigations using telemetry are numerous, but several are limited by low sample size (*i.e.* inadequate tagged individuals), equipment failures and negative effect on the tagged individuals.

Like many species, understanding the life history and management of Galliformes demand specific information related to population distribution, demography, behaviour and genetics. Aside from opportunistic records, knowledge of successful hunters and captive breeders, much of the details on this group of birds are obtained from systematic visual observations and indirect signs such as vocalization, feathers, foraging signs, feces etc. Noninvasive tools such as DNA extraction from feces and feathers (Kohn and Wayne 1997; Taberlet and Luikart 1999) and automated remote cameras (King *et al.* 2001; Rollins and Carroll 2001; O'Brien *et al.* 2003; Winarni *et al.* 2005) have provided additional opportunities to study these birds. However, because of their ground dwelling habits with preference for dense undergrowth and secretiveness, obtaining reliable data on Galliformes proved challenging and significantly large number of studies lack adequate observations or details. Collecting some crucial data on social interactions, movement and demography is almost impossible without monitoring marked individuals. The obvious use of telemetry in



Galliformes studies have been underscored in earlier literatures (Hill and Robertson 1987; Conroy and Carroll 2001). In this paper, we aim to provide only an overview of the capture and telemetry methods relevant for Galliformes and for details; we recommend White and Garrott (1990), Bub (1991), Boitani and Fuller (2000), and Kenward (2001). We also present case studies of Galliformes involving trapping and radio-telemetry in India, and discuss certain general and specific issues envisioning useful insight for future projects.

Trapping Methods

Trapping animal was arguably one of the earliest human activity using specific tools. Of the several techniques adapted over generations of game hunters and Galliformes biologists, successful ones are continued to be exploited, along with increasing sophistications in materials and methods. The number of trap methods that were found efficient for some or other species is exhaustive, but most of these are broadly of (1) Cage or Box traps, (2) Funnel traps, (3) Nets, (4) Nooses, and (5) Spot lighting (see, Bub 1991). Birds are caught in these traps either by automated function that works upon the physical contact of the birds, or by manually driving the birds into the traps and also by way of physical capture. Decoy birds and bait of food items (e.g. grains) are often used to attract the target birds into traps. Though decoy is readily effective especially for Partridges and Francolins, trapping success using bait largely depends on the response of birds. Therefore, in several cases, baiting for some period prior to setting traps proved to lure the birds to baited locations, thereby, increasing the chances of trap success. It is not always possible to allocate time for pre-baiting or to locate right locations, but there are ecologically relevant sites that offer opportunities for trapping. Galliformes tend to use fixed waterholes and roost sites, follow specific routes for foraging and regularly choose certain areas for nesting. These places

could be easily identified by the frequency of their sightings and by their characteristic territorial, courtship and pre-roosting calls. Play-back of recorded calls (e.g. breeding and territorial calls) would also attract the birds to traps. It is apparent that live trapping is a specialized and skillful activity, and that thorough field knowledge about the species and their space use are prerequisites for achieving desired success.

Cage or box traps are efficient for small sized birds (e.g. Quails and Partridges), but return only fewer catches per trap effort. Such traps are generally with automated trigger system that closes the door after the bird entered the trap, and are used with or without decoy or appropriate baits. In funnel types, the traps are designed to have much wider entrance and both sides (walls) become narrower towards the other end in a funnel shape. Width of the dead-end depends on the size class of target species and desired number, and the birds are trapped at the end by snares or nets designed for specific conditions. The trap is placed such that birds walk into the trap on its own, or driven to the trap or lured by baits and decoy birds. Funnel trap is among the most efficient methods of trapping a variety of species regardless of body size, and is particularly useful for most of the Galliformes species. Among the net types, mist netting is commonly used to capture passerine birds, but fall or drop nets are better suited for larger birds such as Galliformes. Camouflaged nets are placed in a strategic location with ground support (e.g. pole) which is connected by a long rope held by the trapper and once the birds reach below the net, the trapper pulls the string forcing the net to fall on the birds. There are also automated drop nets, wherein the poles are pulled down automatically when the birds make physical contact with the nets. In this case, the surface can have a hidden pressure pad connected to a trip wire or poles. Alternately, a portion of the net is spread on the ground, leaving the rest half to be positioned in an angle supported

by poles. When the bird steps on the ground net, the poles are triggered, making the rest of the net to fall down on the birds. Capturing birds by snares made up of series of nooses are among the oldest trapping practices. This type of noose traps are known to yield remarkable trapping success, but potentially cause mild to fatal injuries to the trapped birds. However, a modified version of the snare allowing for trapped bird to reduce the associated risk is found to be efficient for trapping Galliformes species. Also termed

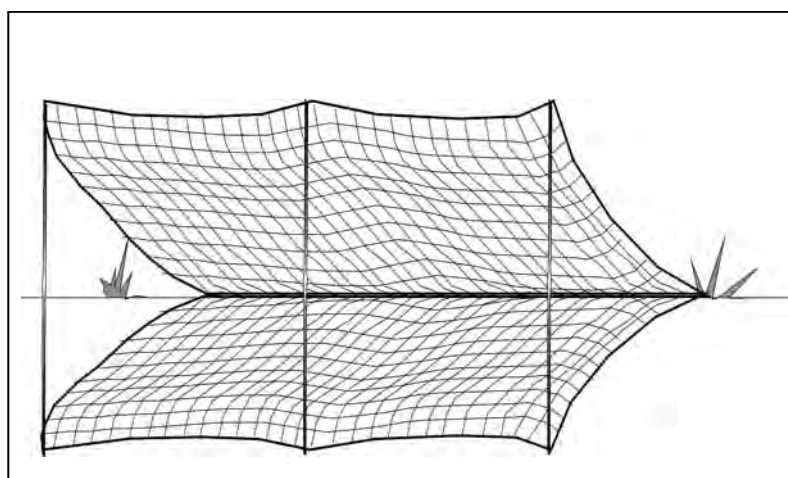


Figure 1 : Fall Net

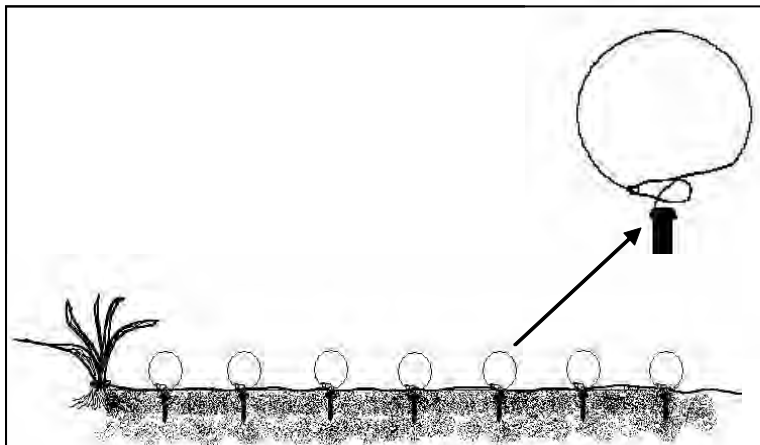


Figure 2. Leg-hold Snare

as leg-hold snare, a series of nooses tied to a long sting at 90° angle is placed at strategic locations along the ground, and the birds moving through this noose trap get caught by their legs. There are also methods where capture is done directly by hand or by spot lighting (or night lighting). Spot lighting is one of the ancient methods and has been found to be productive for many birds. In this method, high power spot lights are directed at the birds sitting on the nest or roost temporarily blind the birds, which are then caught effortlessly by hand or by a net.

Handling Protocol

Once the capture is made, the birds have to be handled for attaching bands or radio tags, recording morphometric data, extracting genetic sample (e.g. blood), veterinary care, transportation, etc. These require keeping the birds in hand for a specific period of time depending on the nature of purpose and equipments involved. Inappropriate handling can cause physical and mental injury, and even lead to shock related mortality. The immediate response of most trapped birds is often the frantic struggle to escape. Unless the bird is held properly, it is likely to experience injury and shock. Experienced trappers immediately cover the birds with dark cloth; so that it can not see the handler and people around, making it to struggle less. While handling, it is important to hold the bird firmly around the upper legs close to the body, where the bones and muscles are stronger to absorb sudden movement. In addition, the bird could be held around the folded wings in case of large sized bird such as pheasants. Conversely, holding the bird by one leg, lower legs, head and neck must be avoided, as this would increase the chances of injury (www.gct.org.uk/psg/policy/livetrappingpheasants). Entire trapping exercise should maintain a first-aid kit for treating any injuries to the birds. If the trapped bird is gasping, it is likely that breathing is restricted by excessive pressure on the body (e.g. wind

pipe or air sac). So, care must be taken. It is also important to avoid pressure on abdomen of breeding female so that the eggs in the oviduct are not affected. While undertaking trapping and handling the birds, it is always advisable to involve more than one person to be able to follow the protocol efficiently. Such help would be particularly important while dealing with large birds and also recording body measurements. The trapped bird must always be released back on the same spot where it was trapped, unless the

requirements demanded otherwise.

Radio-Telemetry

The terms radio-telemetry and radio-tracking are interchangeably used to refer to remote collection of data through radio equipments (derived from Greek 'tele' for remote and 'metron' for measure). The equipments comprise of a transmitter (fitted as radio tag or radio collar) that emits radio signal and receiver equipment along with an antenna to collect signal from the transmitter. Currently, Very High Frequency (VHF: 30-300 MHz) and Ultra High Frequency (UHF: above 300 MHz) transmitters are designed for specific needs (Kenward 2001). However, the VHF tags are commonly used on account of cost, frequency variation suited for studying different species and battery life. After radio collaring of target individuals, tracking could be done on foot by hand-held antenna, vehicle mounted antenna and through satellites. Radio tags are also mounted with GPS (Global Positioning System) and Data Loggers which have automated function to record various data such as geographic coordinates of animal location, activity and body temperature. Several types of radio tags exist for galliformes species, which include Harness/Backpack, Dwyer Backpack, Necklace, Tail Mount, Neck Band and Leg Band. There are several standard companies. Satellite tracking is increasingly utilized in several wildlife studies, specifically for wide ranging large mammals and migratory waterfowls. Among the Galliformes, satellite tracking is perhaps suited for some Quail species that are known to migrate for very long distances across several countries.

Radio-tracking makes the job easier for biologists to collect data that are hard to get from conventional sampling methods. The methods of monitoring radio tagged individuals vary depending on the study questions and radio tracking equipments. Data from radio tagged individuals are collected



in three major ways; (1) Continuous Monitoring, (2) Triangulation, and (3) Home-in. In continuous monitoring method, tagged individuals are followed continuously, even for 24 hours, and this would allow understanding of habitat use and behaviour at large and local scales. This method is, however, difficult to execute for Galliformes since these birds are sensitive to human and tend to evade the observer. Alternately, if the radio tag is fitted with a GPS or Data Loggers, and monitored by an automated tracking protocol including satellite tracking, continuous data collection is possible. Triangulation method uses trigonometry as its foundation and the radio signals obtained from three locations enable locating the tagged individuals adequately. It is an efficient method of data collection suited for wide range of animals since the tagged animals could be located from far distance, and observer effect does not occur. In home-in method, the observer locates the animal directly following the radio signal. Although this method is superior in terms of obtaining information on micro habitat use and behaviour, the likelihood of animal being disturbed by the observer is greater, unless the observer stays within the zone of 'no influence'. All of these methods return location data (*i.e.* animal use), activity and body temperature, and there are several analytical tools available to discern these data for appropriate interpretation (White and Garrott 1990; Aebischer *et al.* 1993; Powell 2000).

Case Studies

In India, Galliformes studies involving telemetry are very few. Iqbal *et al.* (2003) quantified home range, habitat use and nesting of Swamp Francolin (*Francolinus gularis*) on an agricultural landscape in northern India. Grey and Black Francolins were studied in the Yamuna plains of Haryana (Kalsi and Rana 2004; Rana and Kalsi 2004; Kalsi 2005). Among the pheasants, Western Tragopan (*Tragopan melanocephalus*) and Satyr Tragopan were studied using telemetry, though with limited success (Khaling 1999; Ramesh *et al.* 2001). The following provide the details of studies involving trapping and telemetry of Galliformes in India.

Swamp Francolin

Iqbal *et al.* (1995, 2003) studied home range size, habitat use and nesting success of Swamp Francolin (*Francolinus gularis*) on agricultural land in northern India. A total of 13 Francolins in adult plumage were trapped by driving them into mist nets, erected at one end of sugarcane field. Driving was done slowly along most of the length of the field and rapidly towards the end so that the chances of flushed birds getting trapped is high. Trapped birds were attached with necklace transmitter, but one female bird was soon predated upon, leaving the tagged birds to 12 (five males and seven females). The periods of radio-collar attachment and data

collection varied from 2-4 months. The radio-locations were determined by triangulation, with bearings from at least three tracking locations. Given that transmitter range were typically within 250m, the birds were routinely approached very closely such that triangulation error was small and that each location could be reliably assigned to a patch of habitat. Minimum Convex Polygon method and compositional analysis (Aebischer *et al.* 1993) were respectively used to study the home range and habitat use of the species. Breeding behaviour was monitored by following tagged birds, and found that eight of the 12 radio-tagged birds took part in breeding in six pairs. Home range of Swamp Francolin was very small (male = 1,050 m², and female = 822 m²), and interestingly, the home range was positively related to duration of radio tracking, possibly as a consequence of birds moving further once nesting was completed. It is remarkable that there are not many studies in India that had so many radio tagged individuals of a single species for a study. This study has not only provided insights on technical issues related to capturing and radio tracking of Francolins, but has also raised some interesting questions as a result of inexplicable observations on the species.

Grey and Black Francolins

In the years 2002-03, Grey (*Francolinus pondicerianus*) and Black francolins (*Francolinus francolinus*) were trapped and radio-collared for studying their home ranges and habitat use (Kalsi and Rana 2004; Rana and Kalsi 2004; Kalsi 2005). Francolins were trapped with leg-hold snares (Figure 2). Snares were set in previously identified locations at foraging grounds where francolins were frequently sighted. Observers closely monitored the snares from a distance and trapped Francolins were removed immediately from the snares to prevent injury. The Francolins were fitted with backpack radio-transmitters weighing 5 gm each and were released back in the same habitat where they were trapped. Indigenously built radio-transmitters (Kalsi 2004) were used. No bird was injured during trapping. However, on one occasion, a mongoose got trapped in the snare and choked itself to death. A total of 12 Francolins were snared, of which five Grey and six Black francolins were radio-collared. One juvenile Grey francolin was not collared and was released immediately.

The radio-tracking continued till the power supply of the radio-transmitter was exhausted. Out of the 11 radio-collars used, eight lasted for five months; two lasted seven months while one was lost after eleven days of activation. It could not be ascertained whether the radio-collar had failed or the bird was removed afar from the study area by a predator. For home-range estimation, point locations from radio-tracking data were used. Home ranges were estimated using, ArcView 3.1 extension package Animal Movement

Analysis. Models were run using the Universal Transverse Mercator (UTM) co-ordinate system and Minimum Convex Polygon (MCP) method was used to estimate home-range sizes. The home range polygons were overlaid on classified habitat maps of the study area to study habitat use.

Western Tragopan

In 1999, radio tracking of Western Tragopan was attempted in the Great Himalayan National Park, Himachal Pradesh, to better understand movement pattern and habitat use of the species. Six fall nets and nine leg-hold snares were used to trap the birds. The fall net used in this study was a combination of 'automatic fall net' and 'walk-in trap' described by Bub (1991). Nets were considerably long ranging from 15 to 18m, 6m width and the mesh size was 40 x 40mm. All the nets were coloured with black and dark-green stain to give a camouflage effect. The nets were placed in such way that 3m of the net was spread on the ground and the remaining 3m at 50° angle supported by triggers which, in this case, were bamboo sticks (Fig. 1). The net would fall down upon release of trigger when disturbed by the bird walking into the trap. Leg-hold snare had a series of 40 – 50 nooses fixed at 15cm interval in a thin and strong rope (Fig. 2). The noose was made up of nylon, measuring about 30 cm diameter, fixed with a bamboo or any other stick at the base of the noose. The stick measuring 10 cm long and 2 cm girth was pressed into the soft soil, leaving only the noose part on the ground sticking out at 90° angle. One end of the trap was tied with a nearby pole or shrub that holds back the trap when trapped bird tried to pull away from the trap; where as the other end was left loose. This set up prevented the bird from breaking away from the trap, while enabling the bird to move around without inflicting any sort of damage to the leg.

One female Western Tragopan was trapped in the leg-hold snare and was fitted with a necklace type radio transmitter weighing about 50g, which had the potential life span of minimum 12 months. Interestingly, the trapped bird did show any agitation and could be handled without any problem whatsoever. After attaching transmitter, it was released on the same spot of capture. Home-in method to locate the bird was discarded after three consecutive sampling days, as the movement of the bird was found to be influenced by the observer. Rest of the data collection was based on triangulation method systematically recorded at three times sampling (6 – 11 hrs, 10 – 15 hrs and 15 – 18 hrs) every third day. The bird was radio-tracked for six months (from May to November 1999) covering both summer and autumn seasons, after which no signal was received possibly due to transmitter failure or the radio tagged bird was taken away by a predator. Locations were plotted on 1:50,000 scale topographic map and using these points, home range was estimated based on Minimum Convex Polygon (MCP)

method in Animal Movement Extension (beta version) of Arcview GIS software. Habitat use was studied by overlaying radiolocations and home range polygons on the spatial layer on vegetation, elevation, aspect and slope, and also by quantifying habitat variables in concentric circular plots at bird locations. Although trapping was attempted for three months (April - June) with total trap efforts of 256 man-days and 6694 trap hours, trap success of target species (Western Tragopan) was very low with just one bird, possibly attributed to low population density and secretiveness. However, accidental capture of significant number of other ground dwelling birds such as Koklass ($n = 1$), Woodcock ($n = 4$) and Hill Partridge ($n = 4$) indicates that the traps are effective for Galliformes.

Discussion

Trapping of Galliformes is a very old practice, but largely for game hunting, wild meat extraction and cultural requirements. Although these activities are responsible for extinction risk to several Galliformes (Keane *et al.* 2005), the knowledge and skills required and gained over these have also contributed to modern trapping techniques and to the science and management of Galliformes. As the purpose shifted from consumption to management, the real development and efficacy of trapping methods revolved around the ability to capture the birds alive, without inflicting any sort of damage. Unless the methods are efficient and executed properly, live trapping can be a futile and risky enterprise as experienced by several research and conservation projects all over the world. In other situations, even after successful trapping, the birds could be killed by predators if left unattended for prolonged period. Among the several methods evolved and adapted for birds, leg hold snares and nets have been commonly used for live trapping Galliformes. Besides the case studies presented in this paper, leg hold snares have been successfully used for Great Argus (*Argusianus argus*) in Sumatra (Winarni 2002), Silver Pheasant (*Lophura nycthemera*) in Cambodia (Samnang *et al.* 2005) and reportedly of Peafowl (*Pavo cristatus*) in India. Modified form of mist nets have also been used to capture Galliformes. In a study of the mound nesting Megapodes (*Megapodius nicobariensis*) in the Nicobar Islands of India, the birds were caught by chasing into mist nets (Sivakumar 2000). Grey Francolins (*Francolinus pondicerianus*) are illegally caught by a variety of traps that use combination of nets and snares along with baits and decoy birds (Priscilla and Jasmine 2002). Although the available options for traps and trapping techniques are many, it is always desirable to clearly understand the nature of the birds (e.g. size, habitat and behavior), risk involved, and appropriate trapping protocol before embarking on actual field exercise to capture the birds. Such preplanning would not only be cost effective, but would also increase the trap success. Similarly, use of



telemetry in research and conservation projects should be treaded with care as the telemetry is not always efficient due to inherent factors such as battery life, signal range and technical failures. Further, for species such as galliformes that live under the canopy in dense bushes and in mountainous terrain, radio signals are deflected or poorly received. These confounding factors would directly lead to unsystematic or discontinuous data collection, limiting the strength of analysis and interpretation. However, with the deployment of advanced tools and local adjustments in data collection procedure, quality data could be obtained for specified targets.

Depending upon the objectives, the trapped birds are handled for marking or attaching tags, and taking blood and feather samples. Since birds are very sensitive to any extraneous factors, inappropriate handling can cause death or defect normal behaviour. Studies involving marking or tagging generally assume that marking or tags do not affect the animal or that negative effects are irrelevant, but rarely such assumptions have been adequately tested and remain a contentious issue in wildlife studies. A critical review on the effect of marking on animals by Murray and Fuller (2000) highlights these issues and suggests measures for future studies. On ethical considerations, in response to awareness and concern for animals, captures are increasingly governed by national legislations and international treaties, and there are clear guidelines needed to be followed even for publishing research papers (Anon 2001; 2002). It is, therefore, necessary to adhere to these prescriptions in order to prevent the risk of permission being denied or discontinuation of further activity, which would potentially jeopardize the objectives, efforts, investments and publications. More than these regulatory protocols, field research and conservation management are responsible and service-oriented undertakings, and it is expected that the personnel involved accomplish their objectives with sensitivity to data quality and species population in both scientific and ethical terms.

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29.0 Identification of Galliformes using the Microstructure of Feathers: Preliminary Findings

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Introduction

The correct identification of a species is extremely important in wildlife offence cases such as poaching and illegal trade in wildlife. One of the important contribution of wildlife biology is identification of species using a variety of techniques, thereby helping law enforcement agencies and control of illegal trade. Birds are poached for 'meat', 'feathers' and for the illegal pet trade. Identification of birds by studying the fine structure of feathers is not a common practice in India (Grub, 1989; Mathew, *et al.* 2003). Some studies, however, are available in connection with identification of bird hits on aircrafts (Satheesan, 1994; Grub, 1989; Khola, 1988; Sodhi, 2002; Mathew *et al.* 2003).

Identification of bird feathers particularly those obtained after skinning a bird or from other products that are decorated with feathers, has been a difficult task. Due to lack of standardized methods and expertise in this subject in India (Grub, 1989) as well as in most parts of the world (Prast and Shamoun, 1997; Ciecak and Dul, 2007), identification of a species feathers remains complicated. In this connection, the Wildlife Institute of India (WII) has initiated a study aimed to standardize the methodology for identification of birds by studying the fine structure of feather especially for the successful enforcement of Wildlife (Protection) Act, 1972. Preliminary findings of this study, particularly with respect to galliformes are discussed in this paper.

Structure of a body feather

Generally five types of feathers cover the body of a bird: contour, semiplumes, down, bristles and filoplumes. Of these, *contour feathers* are further classified into two categories depending upon their location on the body, typical *body feathers*, and *remiges-rectrices*. The structure of *body feathers* (Fig. 1) is easily reviewed by examining the most familiar type of feathers, those that covering over most of the body (Prast and Shamoun, 1997). The base of the feather shaft is called calamus which is short, tubular and implanted in a socket known as feather follicle. Beyond the calamus is a long, tapered section, the rachis, which bears branches, the barbs, on its sides. The division between the calamus

and the rachis is marked by the lowermost barbs and by a bit on the underside of the shaft, the superior umbilicus. At the bottom of the calamus is an opening, the inferior umbilicus, through which the pulp enters a feather while it was growing. The rachis is composed of an outer thin, solid layer, the cortex, and an inner, thick, spongy core, the medulla or pith. The barbs on each side of the rachis constitute a sheet known as a vane. A barb consists of an axis, the ramus, and many closely spaced branches, the barbules, or radii. A barbule is essentially a stalk of single cells that are serially differentiated to some degree. It has a base of compressed, fused cells and a distal segment, the pennulum, of cylindrical, jointed cells. In a downy barbule (plumulaceous), the base is short and straplike, and the pennulum is long and simple, resembling a stalk of bamboo. The distal ends of the pennulum cells are variously swollen or furnished with tiny prongs. Pennaceous (distal) barbules are often highly differentiated and diverse outgrowths, collectively termed barbicels. Proximal barbules, those facing the proximal end of a feather, have a pronounced flange along the dorsal edge of the base, and barbicels that are small, simple, or absent. A barbule has different types of nodes, basal nodes, which are distributed towards the base, distal nodes are the areas towards the tip of the barbule, middle portion of the pennulum is called middle nodes and the terminal node is the distal-most node on the barbule (Prast and Shamoun, 1997).

Methods

Various zoos and wildlife field biologists were requested to collect feathers from different localities spread throughout the countries. All the collected feathers were labeled with information such as name, sex of the species, place, date of collection, type of feather along with name of the collector. After receiving the samples from the field all the labeled information was recorded in the laboratory file. If the feather sample was in good condition then it was considered for further identification. Typical *body feathers* or *down feathers* were used to study the fine structure of the feathers. *Body feathers* were chosen because of its ubiquitous distribution



over the body of a bird and they have two distinct regions called pennaceous and plumulaceous. First, entire feathers were scanned for its colour patterns. Both pennaceous and plumulaceous colours and its barb distribution patterns were noted. These features often provide sufficient basis for definitive identification by experienced ornithologists. Afterwards, a barb from plumulaceous region was picked off without damaging any part of the barb and mounted on the slide by using DBX mountant. After drying the slides for 12 hours at room temperature, they were observed under high-power optical and light transmission binocular microscope attached with video screen (Sony, Trinitron). Image of the barbules was viewed and read on the screen. With the help of cytometer (0.01 mm accuracy), length of barbule, length of internodes and length of basal nodes were measured. Number of nodes in the entire pennulum was counted and its distribution patterns also recorded. Structure of node, intensity of pigmentation, structure of prongs and terminal nodes were observed. After studying the fine structure of barbules, a part of barb was photographed by using the Black Box of Nikon camera, which was also attached to the same microscope. All the slides were carefully preserved for future reference.

In order to differentiate the bird groups by using all the morphometric and meristic characters of barb, discriminant function analysis was used with all those variables for which the data were recorded. Measuring the length of a barbule was much easier than counting the number of nodes in a barbule. If there is a correlation between the length of barbules and number of nodes then it may be advisable to avoid time on counting the number of nodes present in barbule. Correlation test was performed to find out the relationship between the barbule length and number of nodes, the length of internodes and number nodes.

Finally, a reference sheet was prepared for each species with the help of existing literature references. Each reference sheet gives information regarding the classification of species, local name, general body appearance, distribution range, population status, legal status and microstructure of feathers, which includes colour, length of barbule, number of nodes, length of internode, nodal structure, structure of terminal node, prong structure, node distribution, node density, length of basal node and pigmentation. Apart from this, a picture of the species, scanned picture of the feathers and a photograph of a part of the barbule was also included in the reference sheets (see example Reference sheet of Temminck's Tragopan).

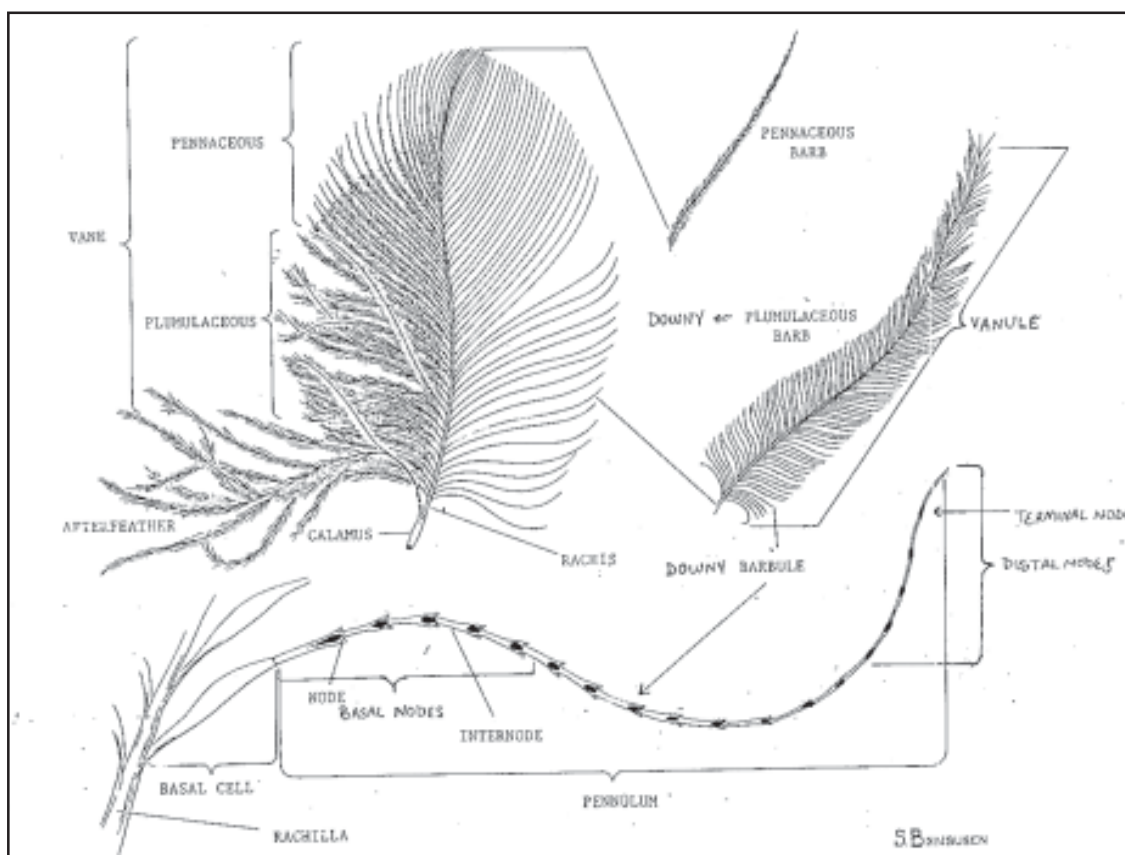


Figure 1. Structure of a contour feather (Source: Prast and Shamoun, 1997)

Results

A total of 64 feather samples were received from various zoos and some wilderness areas of India. Of these, 30 samples belonging to 24 species representing five orders were found suitable for the study. Of the 30 samples, 10 samples belonged to galliformes, which included eight wild species and two domestic fowls (which had two different body colour). In total, nine characters of a barbule were used to discriminate the five groups of birds. Of the nine characters, total number of nodes in a barbule, density of nodes and structure of prongs were extracted by the test as being highly useful to discriminate the five groups of birds *viz.* Galliformes, Pelecaniformes, Falconiformes, Coraciiformes and Psittaciformes. Pelecaniformes could easily be differentiated from other groups because of its very low (or even absence) pigmentation and its number of nodes. Psittaciformes and Coraciiformes are very close, however, these groups were distinct due to the differences in the sizes of the basal nodes. Hornbills have longer basal nodes compared to the parakeets. Apart from basal node, structure of nodes was also useful to differentiate these two groups, hornbills has narrow nodes. However, parakeets had heart-shaped or triangular shaped nodes. Compared to parakeets, hornbills had less pigmentation on the barbule. Because of identical prong structure and number of nodes,

these two groups appeared to be close. Group centroids of all five groups of birds occupied different locations in a plot, which were separated along the extracted characters of barbule.

Galliformes (Phasianidae)

A total of 10 birds belong to eight species of wild birds and two domestic fowls which had two different body colour were studied (Table 1). All the species were discriminated (DCA) using the feather characters such as the total number of nodes in a barbule, density of nodes and structure of prong. Red Junglefowl (RJF) and Western Tragopan (WT) were close, however, RJF was slightly different from WT because of nodal shape. RJF has prominent triangular shaped nodes and WT also has triangular shaped nodes but very narrow. Pigmentation was also more in WT barbule than in RJF. Ring-necked Pheasant, Grey Junglefowl and grey coloured Domestic fowl were very close, however, these species were different due to different shaped nodes and length of prongs (Table 1). Interestingly, grey coloured domestic fowl and red coloured domestic fowl were varied widely, however, these two birds have identical node structure. Three species of tragopan were studied and found that all the species varied due to different structures of node, terminal node and prong.

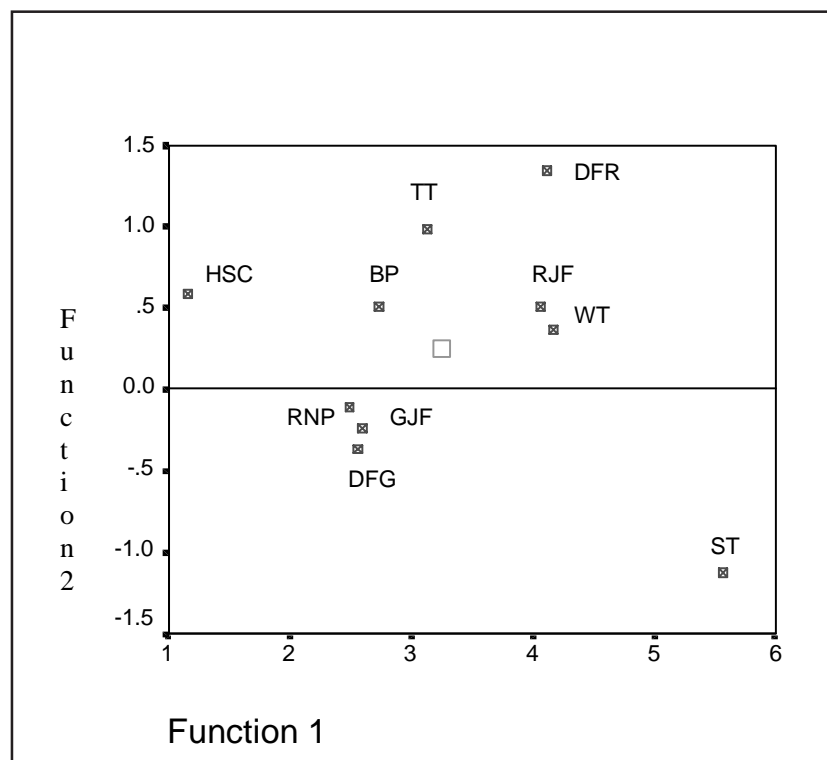


Figure Plot of species centroids on the first two axis derived from a discriminant function analysis to classify species by fine structure of feather (Function 1: number of nodes and structure of prongs, function 2: node density). TT- Temminck's Tragopan, DFR - Domestic fowl (red in colour), HSC - Himalayan Snow cock, BP - Burmese Peafowl, RJF - Red Junglefowl, WT - Western Tragopan, RNP - Ring-necked Pheasant, GJF - Grey Junglefowl, DFG - Domestic fowl (Green in colour), ST - Satyr Tragopan.



Discussion

Bird species could be identified at three different levels depending upon the type of samples which can be received from the field station or from the enforcement authorities. If the sample is a whole bird then it could be identified without any difficulty by referring to the Part-I of the 'Reference Sheets' (see Reference Sheet of Temminck's Tragopan) or the available bird field guides. If only feathers are received, it also could be identified without much difficulty except in case of some groups of birds such as warblers, babblers, raptors and female birds of most of the groups, by referring the Part-II of the Reference Sheet. Third level of identification is required if a part of the feather (plumulaceous portion) is received, or which could not be identified using the first two parts of the Reference Sheet and would be identified with the Part-III that describes the microstructure of the barbule.

Combination of both morphometric and morphological characters of barbules are essential for the identification of birds at group level. The total number of nodes in a barbule, density of nodes and structure of prong appears to be unique to a group. We believe that these characters are useful for the group identification. Sometimes, species could also be identified by studying these characters of a feather. Pelecaniformes can be easily differentiated from the other groups (studied) because of either low or absence of pigmentation on barbule. Once the bird group is identified, for then the species level identification, a combination of both morphometric and morphological characters such as structure of nodes, terminal node and the length of basal node is required. In the case of Falconiformes species could be identified by the using the same characters, which were used for the group identification. However, in the case of Pelecaniformes, morphological characters of barbule alone may not be useful to identify the species since almost all the species have similar morphological features. Due to difficulties in getting the samples of more species belongs to Psittaciformes and Coraciiformes (Bucerotidae), it may not be appropriate to comment on these groups based on low sample size.

We strongly believe that if birds were identified at group level then it would not be difficult in identifying the same at species level since we have preserved the Reference Slides of all the species studied. Our preliminary experiment clearly shows that different birds belonging to the same species may have different meristic characters but will certainly not have different morphological characters such as structure of nodes, prongs, terminal nodes and the intensity of pigmentation on the barbule.

Conclusion

Our study demonstrates that identifying upto order level such as Galliformes, Pelecaniformes, Falconiformes,

Coraciiformes and Psittaciformes using the fine structural characters of feather is possible. The reference sheets and slides prepared through this study will aid in this process. However, going upto species level remains a limitation. Parameters such as number of nodes, shape of the nodes, and pigmentation distribution will be helpful regarding identification at species level. We had some difficulties while describing the structure of nodes due to vague shapes, in this case we could refer the previously mounted slides for clarification as well as confirmation. Since all the slides of studied species are preserved, identifying them won't be a problem. This study has demonstrated the usefulness of the present approach for primarily five bird orders. However, with the availability of more samples from other groups in trade, the scope of this study could be expanded.

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**Table 1 :** Microstructural characters of Down Deather of selected Galliformes.

Name	Length of barbule (mm)	Nodes (Nos.)	Basal node (mm)	Internode (mm)	Density of nodes/mm of barbule	Node structure	Pigmentation	Terminal node	Size of Prongs
Domestic fowl (grey in colour)	2.66	43.57	0.13	0.06	16.86	Triangular	Low	Flared	Large
Domestic fowl (red in colour)	3.86	61.71	0.16	0.06	16.42	Triangular	Neck region of nodes has thick pigmentation	Flared	Small
Grey Junglefowl	2.09	35.57	0.15	0.06	17.87	Triangular	High	Flared	Medium
Red Junglefowl	2.61	46.00	0.12	0.05	18.04	Ring like	Low	Flared	Small
Ring Necked Pheasant	1.90	31.29	0.16	0.06	17.38	Slightly triangular shaped	High	Flared	Small
Himalayan Snowcock	4.02	59.57	0.14	0.07	15.12	Ring like	Medium	Un-flared	Nil or very small
Satyr Tragopan	4.26	63.14	0.10	0.07	14.95	Ring	Low	Usually not flared	Nil or very small
Temminck's Tragopan	3.83	59.29	0.21	0.06	16.11	Triangular	Medium	Flared	Medium
Western Tragopan	3.35	51.00	0.21	0.06	15.91	Triangular like	Medium	Usually not flared	Small
Green Peafowl	1.81	33.86	0.14	0.05	19.67	V shaped	High	Usually not flared	Small



Reference Sheet

Temminck's Tragopan *Tragopan temminckii*

Classification:

Order: Galliformes

Family: Phasianidae

Local name(s): *Bop* (Tibet); *Oua oua ky* (China)

Part I (Fig 1)

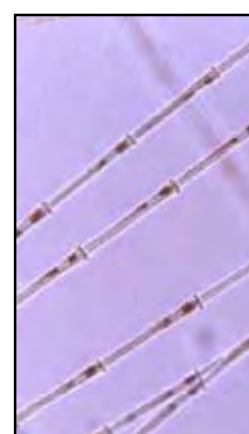


David Mead

Part II (Fig 2)



Part III (Fig 3)



General appearance: Male has grey spotting on red underparts, and red colouration to upperparts. Female has prominent white spotting on underparts (Fig 1).

Distribution: Resident East Himalayas in Arunachal Pradesh.

Status: Rare

Legal status: The Indian Wildlife (Protection) Act, 1972: Schedule I – Part III

Feather Characteristics:

Colour : Pennaceous portion is smaller than plumulaceous vane. Pennaceous region with or without larger, greyish drop-shaped spotting, surrounded by red colour. Plumulaceous barbs are blackish in colour (Fig 2).

Length of barbule: Small/Medium/Long, average length of barbule is 3.83 (± 0.21) mm. Fig 3.

Terminal node: Terminal node is flared and has cilia like three prongs at the tip.

Prongs structure: Short and cilia like prongs at the slightly enlarged nodes.

Distribution of nodes: Uniformly distributed throughout the barbule

Node density: 16.11 nodes mm^{-1} , an average number of nodes per barbule is 59.28 ± 2.97

Length of basal node : 0.21 mm

Pigmentation: More pigmentation stippled in the node regions but it gradually diminished towards the tail.



30.0 Pheasant Conservation in India (1980-2008)

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The true dawn of work on pheasants in India was heralded by an International Symposium organised by the World Pheasant Association (WPA) in Srinagar (Kashmir) in the autumn of 1982. It was jointly organised with the Indian Chapter of WPA and reflected even then the contemporary concerns of species conservation: biology, threats, and conservation action.

At this point, both zoos and private breeders held collections of some of India's pheasant species, but studying them in the wild was still in its infancy. The Himachal Wildlife Project (1980, 1983) was seminal in formalising quantitative survey work and providing a training ground for its many Indian participants. It yielded the first contemporary data in India on the status and ecology of Western Tragopan and Cheer Pheasant, then believed to be amongst the rarest pheasants in the world. It also identified a site for what is now the Great Himalayan National Park, as representative of Western Himalayan moist temperate forest.

This all laid the foundations for intensive studies of the ecology and behaviour of cheer white-crested kalij and other Galliformes, as doctoral training projects in what is now Uttarakhand and in Himachal (1985-90). At the same time the first surveys were undertaken in the north-east hill states, to which many of India's pheasant species are restricted, as well as in Kashmir.

The founding of the Wildlife Institute of India (WII) in Dehra Dun (1986), and the initiation of a Masters programme in Wildlife Science at Aligarh Muslim University around the same time, provided much needed institutional bases for an emerging cadre of experts focused on pheasant studies right across the northern hill states.

By 1990, it was possible to use the information gained on some species to raise their profile as flagships for broader conservation action. The Western Tragopan and the Himalayan Monal have become the State Birds of Himachal Pradesh and Uttarakhand respectively, and Blyth's Tragopan was a symbol for forest conservation in Nagaland. WPA also established a South Asia Field Office in Delhi to steer a regional strategy for the next 15 years.

A second WPA symposium was held at the WII in 2004, providing a showcase for the voluminous and sophisticated work that still continues apace. Studies of distribution have discovered a new all-white tailed subspecies of Sclater's monal in Arunachal Pradesh, and confirmed the Western Tragopan in Uttarakhand. The impact of pesticides on Indian Peafowl has been investigated, as has the extent of bushmeat hunting for pheasants in both the northwest and northeast Himalayas. A much needed investigation of interactions between Red Junglefowl and domestic fowl is in progress. A strategic analysis of protected area coverage and management in Uttarakhand is nearing completion. A major initiative in conservation breeding is now focused on Western Tragopan in Himachal, under the auspices of the state government. And community-based conservation projects with pheasant and forest conservation as their focus are continuing in the Great Himalayan NP, at Munsiri in Uttarakhand and near Kohima in Nagaland.

Over the past 25 years, a great body of reliable data has been accumulated. Current activity built on this still reflects the three main preoccupations of conservation science: state (species biology), pressure (threats) and response (conservation action). Geographical and habitat distributions are largely known, but population biology and the real impacts of threats are still not well understood.

Translating research results into feasible conservation policy and action remains a huge challenge. It is here that the worlds of science, sociology, economics and politics meet: stakeholders are many and complexity is daunting, but workable solutions must be found if species and their habitats are to be saved for posterity. Our hope must always be that management for pheasant conservation, which also reduces both direct (hunting) and indirect human impacts, is implemented and then monitored for its effectiveness. There is no case yet in India where the principle of adaptive management has been applied, so we are still some way from being able to claim that we have 'solved' the problem of conserving even just one of India's 17 species. We certainly have the knowledge and expertise, but the 'implementation, monitoring and modification' package remains as a very challenging tail-piece to any conservation story.





31.0 Partridges, Quails, and Francolins in India : Conservation in a Center of Biodiversity

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Among the Galliformes, the partridges, quails, francolins and snowcocks are an eclectic group that encompass a diversity of systematic relationships. These species range from lowland tropical forest to the highest elevations in the Himalaya. This wide range is also reflected in the diversity of habits and habitats from rare endemic specialists to generalists found over a wide swath of Asia. It also includes one species, the Himalayan Quail (*Ophrysia superciliosa*), which has not been officially reported since the 1850s, but enough anecdotal reports have kept it from being declared officially extinct.

India has 27 species of partridges, quail, and francolins. The unique location as a crossroads of Asia has resulted in India containing a diversity of species which have centers of distribution in either eastern Asia, or western Asia and Africa. Of the species found here, two species, the Common Quail (*Coturnix coturnix*) and Japanese Quail (*Coturnix japonica*) are migratory, and the latter is only a sparse winter visitor. Two genera contain the largest number of species in India, *Arborophila*, or the hill-partridges, and *Francolinus*, the francolins. Two species of the closely related Spurfowl are also found here. *Arborophila* species are centered on SE Asia and India represents the westward extension of the genus, conversely, the francolins are centered on Africa and India contains most of the species found at the eastern extent of the genus. There are some mountain specialist genera including the *Tetraogallus*, for which 2 of the 8 species are found here. In India, both species are generally found >3,500m and up to 6,000m making the snowcocks among the highest elevation birds in the world. The monotypic Snow Partridge (*Lerwa lerwa*) is another high elevation Himalaya specialist, again found >3,500m.

In conserving the partridges, quails, and francolins, Indian biologists and conservationists are making enormous strides forward. Over the last 15 years we have seen a diversification of conservation research encompassing some

of the more obscure species—this trend needs to continue. Although research on both *Arborophila* and *Francolinus* continues to increase, human pressures at moderate and lower elevations and ecosystems that these species inhabit also continues to increase. In particular, monitoring and conservation work on the lowland specialist, Swamp Francolin (*Francolinus gularis*) must be a priority. The Chestnut-breasted Hill Partridge (*Arborophila mandelli*) also deserves more attention. The Manipur Bush Quail (*Perdica manipurensis*) continues to be poorly studied, and its grassland habitats threatened. The key species in this discussion is the Himalayan Quail. There is no doubt that additional resources and expeditions to potential localities are necessary to verify the final status of this species. If it proves to be extant then conservation efforts must be put into place.

There are a couple of important ideas that are critical to the future of Galliformes and conservation. The first is that we must all upgrade the quality of our research. This is not just an issue in India, but globally much conservation research could be done better, more efficiently, and create a wiser use of limited conservation money. Secondly, we have seen many of the forest partridge, quail, and francolin species of India decline in numbers and distribution as a result of forest destruction and agricultural development. Conservation research and management has been initiated and warranted for these species. However, even though many of the grassland associated species have traditionally been more adapted to human impacts on their ecosystems, and often do well in agricultural areas, we cannot overlook the rapidly changing dynamics of global agriculture. The low impact farming practiced in many parts of Asia is being replaced by modern industrial farming. As has been seen in parts of Europe and North America, this potentially has a significant negative impact on those species that have been thought to be safe. We ignore warning signs for some of these species at our peril.



32.0 Priorities for future Research and Monitoring

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India has made huge strides in understanding the conservation status of its Galliformes and their habitats in the last 30 years and some of this research is reviewed by Kaul (2005). In the mid-1970s, very little was known about even the basics of distribution and status for most species and the information that was available was rarely used for conservation planning. Now the situation is so different and there are many active fieldworkers (see for example the papers in Fuller and Browne, 2005) and the state of the environment increasingly recognised as a mainstream political agenda item. However, despite these crucial strides there are simply not the scientists or funds to undertake all of the scientific work that, in an idea world, should be carried out to guide conservation decision-making and management. Therefore, every effort should be made to ensure that future work is as useful and well-targeted as possible.

Priority species

The World Pheasant Association (WPA) has developed a scheme that is used in the prioritisation of work on

Galliformes species (Figure 1). As a simple rule we wish to move down this chain as quickly as possible, but only when we have enough information to be sure that it is possible to draw satisfactory conclusions at each stage. Even this scheme, however, suggests a huge amount of work in India, which is home to so many species.

IUCN (2006) states that 48 species of Galliformes in India have been evaluated for inclusion on the IUCN Red List and that 34 are currently considered Least Concern, four are Near-threatened, nine are Vulnerable and one is Critically Endangered. Therefore, these 10 species are clear global priorities and there is a need to ensure that scientific research is at least at stage 4 and preferably at stages 5 and 6 for all of them. For some of these species there is good quality information, but it is not yet widely available in the public domain. For example, the Cheer Pheasant (*Catreus wallichi*) and Western Tragopan (*Tragopan melanocephalus*) were two of the most high profile species amongst Galliformes conservationists anywhere in the world during the 1970s and 1980s. As a result, a considerable amount of research has been carried

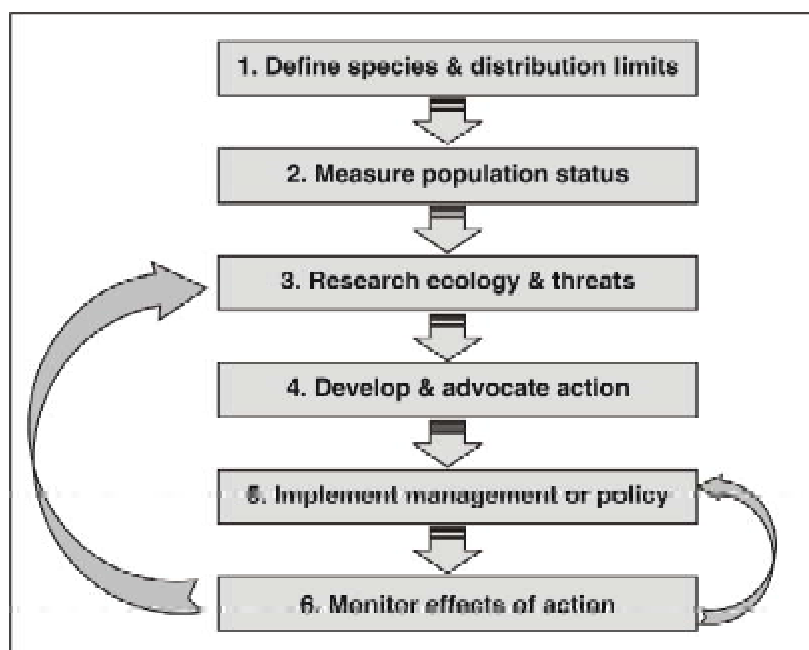


Figure 1. Steps in conservation from taxonomic ignorance to measurable conservation benefit (based on Fuller *et al.* 2003).



out on both species, but much has not been published in peer-reviewed journals and so, very regrettably, remains of very limited (if any) use. In due course, this lack of dissemination of results may well mean that the research has to be undertaken all over again and this would be a great shame given the scarce resources that have already been spent gathering information so far.

Species that are not on the Red List should also be assessed periodically to ensure that they are listed in the correct category. Arguably the Red List is biased towards species that have small populations and/or small geographic ranges. Therefore, species that are commonly thought to be widespread may be overlooked or inadequately assessed. Consider for example, the Grey Junglefowl (*Gallus sonneratii*) or Himalayan Monal (*Lophophorus impejanus*). Can we be confident that their areas of occupancy, habitat use and population trends are all well enough known for their Least Concern listing?

Priority areas

Clearly, gathering species by species information on all of India's Galliformes is not practical simply because of the resources needed to accomplish this for all 48 species. Therefore, areas of the country where there are high concentrations of species or large numbers of threatened species provide the opportunity for multi-species studies. One such area is obviously North East India, where our knowledge of Sclater's Monal (*Lophophorus scalteri*), Blyth's Tragopan (*Tragopan blythii*) and Hume's Pheasant (*Symaticus humiae*) remains inadequate for systematic conservation management. There are also large parts of India south of the Himalaya where there is considerable scope for assessing the ecology and conservation prospects of Galliformes assemblages.

Considering the spatial scale at which conservation management is typically carried out, however, we should be identifying management and monitoring needs at the state or Protected Area (PA) level. Table 1 shows National Parks and Wildlife Sanctuaries in India that were considered *globally* important in 1999 for ensuring that Galliformes on Asia are adequately represented in the network of PAs (McGowan et al. 1999). This analysis should be revised incorporating new distributional data and information on the status of PAs. Crucially it should go further than the previous analysis and seek to determine whether there is sufficient suitable habitat within each PAs to sustain populations in the long-term. This may see some of the sites listed in Table 1 replaced by other PAs as their long-term viability is called into question. A further analysis should be undertaken at the national level to ensure the best management for Galliformes in a subset of the country's impressive number of PAs.

Flagships and awareness

It is not only immediate threat that should drive attention to species research. There are at least two Indian Galliformes that have exceptional potential to be emblematic for the conservation of the whole group and their habitats. These are the Indian Peafowl (*Pavo cristatus*), the National Bird, and the Red Junglefowl (*Gallus gallus*) because of the cultural and religious importance of the former and its ancestry of the domestic chicken of the latter. Therefore, research that will best position our ability to capitalise on conservation opportunities that may arise outside the usual narrow confines that Galliformes researchers work within would be very timely. Some of this is underway, but results need to be communicated accurately, succinctly and quickly to a wide audience.

Developing approaches and methods

Even when trying to identify a suite of priorities as above, it is very easy to end up with a long 'wish list' of activities that should be carried out to underpin conservation policy and management. Whilst these are all needed and would add substantially to our ability to make better conservation decisions, it is also necessary to continually seek new approaches and methods to Galliformes research and conservation. There are increasingly sophisticated methods available to researchers for activities such as monitoring populations at various spatial scales. These should be pursued wherever possible as it will allow increasingly efficiency in research efforts. One example of this is the current Wildlife Institute of India-World Pheasant Association project entitled *Key areas for long-term conservation of Galliformes in north-west India* (see Ramesh et al. 2006). This project seeks to provide an overarching assessment of the status of Uttarakhand's 22 species of Galliformes and identify the key conservation needs. It is doing this through an innovative combination of a landscape-level sampling of the species' distribution within the state and extensive field surveys. These can then be combined to produce assessments of key sites and management needs.



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Table 1 : List of Protected Areas in India considered in 1999 to be important for the most efficient representation of Galliformes in the World's Protected Area network (from McGowan *et al.* 1999).

Protected Area	State
Dibang Wildlife Sanctuary	Arunachal Pradesh
Intanki National Park	Nagaland
Mehao Wildlife Sanctuary	Arunachal Pradesh
Melghat Wildlife Sanctuary	Maharashtra
Murlen National Park	Mizoram
Pakhui Wildlife Sanctuary	Arunachal Pradesh
Phwangpui National Park	Mizoram
Singhalila National Park	West Bengal
Wynad Wildlife Sanctuary	Kerala
Bandhavgarh National Park	Madhya Pradesh
Corbett National Park	Uttarakhand
Dudwa National Park	Uttar Pradesh
Govind Pashu Vihar Sanctuary	Uttarakhand
Great Himalayan National Park	Himachal Pradesh
Karera Wildlife Sanctuary	Madhya Pradesh
Manali Wildlife Sanctuary	Himachal Pradesh
Manas Wildlife Sanctuary	Assam
Pench (Priyadarshini) Wildlife Sanctuary	Madhya Pradesh





33.0 Conserving the Galliformes of India : *Ex situ* Conservation Breeding and Re-introduction

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The *in situ* conservation of any species must always be the highest priority, and within this publication, others will address many aspects of how we can help India's galliformes to survive in their natural environment. In December 2002, IUCN recognised that *in situ* conservation may not always be sufficient to ensure the long term existence of many species throughout the world. The publication of the IUCN Technical Guidelines in the management of *ex situ* populations for conservation¹ has recognised that there are a wide range of complementary conservation approaches, including for some species, the use of *ex situ* techniques.

The IUCN documentation goes on to advocate that, "If the decision to bring a taxon under *ex situ* management is left until extinction is imminent, it is frequently too late to effectively implement, thus risking permanent loss of the taxon. Moreover, *ex situ* conservation should be considered as a tool to ensure the survival of the wild population ... and ... effective integration between *in situ* and *ex situ* approaches should be sought wherever possible". If *ex situ* conservation breeding programmes are to be established in India, then, obviously, priority should be given to the management of threatened taxa.

Keeping pheasants in captivity requires considerable expertise and dedication. In many cases, zoos and other licensed pheasantries have struggled just to keep birds alive in captivity, particularly when Himalayan species are housed under tropical conditions. Only when birds are able to be kept alive, can any form of breeding be considered.

Some galliformes will breed readily in captivity, although usually the rarer the species, the more difficult it is to breed. Successful breeding might involve artificial incubation of eggs, the use of broody chickens or natural rearing by the pheasants themselves. Unless such Captive Breeding is planned in such a way as to encourage natural characteristics, the young birds that are bred often compare very poorly to their wild ancestors.

Conservation Breeding is an advanced science, where the skills learned in keeping birds alive and then breeding them

in captivity are taken to a higher level. The keeper needs to be able to think like a pheasant, to design aviaries that encourage natural behaviour and to provide an environment where the birds feel sufficiently at ease that they raise their own young and teach them valuable life skills. In a paper as brief as this, it is not possible to provide in depth justification for the principles that have evolved from practical experience within the World Pheasant Association (WPA). However, there is a growing body of practical experience which has resulted in a number of re-introduction projects for pheasants in Asia.

From the outset, a deep knowledge of the needs of each individual species is required. Although it is possible to advocate some general guidelines for conservation breeding and for re-introductions, specific protocols for each species need to be developed. For example, a number of the megapodes play no part in the rearing of their young once they hatch, whereas other species care for their young for up to a year or more. The Peacock Pheasant species lay a clutch of just one or two eggs and the hen commits an immense amount of effort to ensure the survival of her young, whereas the game pheasant may hatch more than a dozen eggs and rapidly lose young because she cannot count beyond two or three. Most pheasant species are reared by just the female, who also does all of the incubation, whereas both the male and female Cheer pheasant are integrally involved in raising their young. Tragopans are unusual pheasants in that they nest in trees and are very arboreal. In captivity, we provide them with a number of perches for them to roost on at night. However, these aviary perches seldom offer the bird an opportunity to conceal itself within foliage, as its wild relatives would do. Thus, if a tragopan is released from captivity as part of a re-introduction programme, it will almost certainly roost on an open perch and fall victim to the first nocturnal predator that comes along.

Conservation breeding of galliformes in India is a multi-disciplinary process requiring the co-ordination of expertise and enthusiasm from many constituents. Experience has taught us that management at all levels needs to be fired with a uniform enthusiasm since the weakest link in the chain is



likely to cause projects to founder. When key personnel leave the project, there needs to be sufficient handover time to ensure that continuity takes place, since these key appointees will require similar enthusiasm and expertise to their predecessors. Wherever possible, long-term commitment to such projects will undoubtedly bear the best fruits.

Aviary Construction

A key point in encouraging pheasants to rear their own young is to construct aviaries that are specifically designed to encourage this natural behaviour. They need plenty of cover for hens particularly since, in captivity, some more amorous cocks will pester their females unceasingly. The birds themselves need to feel secure within their aviary. In many re-introduction programmes, there has been an underlying policy of keeping human contact to the minimum to ensure that the animals retain a natural fear of humans. However, the author's experience has been that it is comparatively easy to encourage a tame pheasant to adopt wild behaviour patterns, whereas a wild pheasant will seldom feel sufficiently secure to breed well in an aviary. Signs of insecurity can often be noted when hens drop eggs anywhere within the aviary, or even whilst standing on their perches. Egg eating is also quite common. Nature has dictated that the birds must lay eggs at a certain time of the year, but the hen does not feel sufficiently secure to attempt to nest, so eggs are expelled anywhere.

A variety of possible nest sites must be provided, but all of these should encourage the hen to select a site that remains dry in all weathers. A diversity of natural plant life and foliage should be made available to encourage the birds to experiment and also to provide insect life on which they can feed. Most pheasant species vary their natural diet quite considerably during the breeding and chick-rearing seasons and we must provide them with this opportunity. We find that most families need quite large areas of grass at some stage of the rearing process.

Finally, the aviary should be sufficiently large for the whole family of birds to over-winter without decimating the natural foliage. In the case of birds that dig a great deal, or have large broods of young, such as Cheer Pheasants, we need to consider immense aviaries, probably well in excess of 3000 sq. ft. This is often outside the financial capabilities of most zoos and pheasant breeders. An alternative is for the breeder to work extremely hard at persistently revitalising rather smaller aviaries, but this can be very labour intensive.

Re-introduction is expensive, and takes much longer than is usually expected at the outset. However, with WPA's experience, we would argue that, far from using up

valuable funds, re-introduction projects, with their attendant publicity and tangible goals, attract money and interest to conservation policies in general and these will benefit all forms of wildlife.

Below is a synopsis of key points relating to conservation breeding and re-introduction of pheasants :

1. Provide suitable aviaries designed specifically to encourage pheasants to rear their own young as naturally as possible.
2. Encourage the parent birds to feel secure within their aviaries so that they will wish to breed naturally.
3. Provide plenty of foliage within the aviary to help the birds vary their diet more naturally and allow the young to over-winter with their parents to learn natural behaviours.
4. Before considering re-introduction, allow the parent birds to gain breeding experience so that they can provide the best opportunities for their young. If wild caught birds are being used as the founder stock, this process may not be necessary.
5. Ensure that a good regime of hygiene control is in place at all times in the conservation breeding pens to guard against the spread of bacterial and viral infections.
6. Have a policy for encouraging the release stock to become wilder prior to release, but not necessarily in the early days of their lives.
7. Undertake field research to determine the suitability or otherwise of any potential re-introduction project.
8. Ensure that suitable habitat is available for re-introduction, and that the reasons for the birds' previous extirpation no longer exist. A "Communities" programme and education might be very necessary before and during any re-introduction. With Cheer pheasants, it would seem to be vital that the habitat is maintained, probably in partnership with local villagers.
9. Have a policy for predator control related to the birds and their environment, particularly during the early days of release.
10. A number of release pens scattered through the release area(s) is probably better than one large pen.



11. Released birds should be monitored to evaluate their success or failure. Close monitoring using radio tracking devices can utilise human presence to discourage predators at a time when released birds are most vulnerable. Research indicates that released birds learn most of their survival skills in the first month of release.
12. Evaluate beforehand what realistic factors will be considered as “successful re-introduction” and consider how long such a Project might continue.
13. Use the IUCN Re-introduction Guidelines and the IUCN *Ex situ* Guidelines to assist in any deliberations prior to, during and after the Project.

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34.0 Selected Bibliography on Galliformes of India

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Introduction

A large volume of scientific information on Galliformes of India is available but widely scattered. Proper literature documentation is important to easily access appropriate and relevant literature on a given subject. Therefore, a detailed literature survey was carried out on galliformes of India. We could compile 728 references that are in English language. This bibliography covers a time period of 160 years of time period (1848-2007).

The following secondary sources were consulted during the compilation of this bibliography:

- a) International Database
Wildlife and Ecology Studies CD-ROM (Period 1935 – 2007)
- b) WII Library and Documentation Centre in-house Databases
 - i) Reprint Database
 - ii) Book Database

WILD Database (Indexing and Abstracting Database of Indian Wildlife)

To make bibliography more user friendly, the bibliography has been supplemented with three indices for easy access to the citations.

- a) The Author index
- b) The Subject Index
- c) The Publication Year index

Each paper/ article in the bibliography has been categorised on the basis of 14 broad subjects as shown in Table 1. Among these 'Status/distribution' followed by 'Conservation and Management', 'Behaviour' and 'Breeding' dominate the database.

Table 1 : Distribution of Bibliography in Broad Subject Areas

S.No.	Subject Area	No. of References
1	Status/Distribution	361
2	Conservation & Management	118
3	Behaviour	103
4	Breeding	68
5	Habitat	56
6	Natural History	27
7	Captivity	17
8	Taxonomy	16
9	Population Studies	16
10	Techniques/Tools/Analysis	14
11	Wildlife Trade	11
12	Morphology	7
13	Wildlife Health	7
14	Miscellaneous	11



Over 333 authors have been indexed in the present bibliography and their contribution in terms of number of publications ranged from 1 to 64. Further analysis of the database showed that 438 out of 728 references have been contributed by one author as shown in the Table 2. The remaining 290 references were contributed in collaboration by two or more authors.

Table 2 : Authorship pattern observed in the Bibliography

S.No.	Authorship Pattern	No. of References
1	Single	438
2	Two	147
3	Three	83
4	Four	29
5	Five	6
6	Six	4
7	Eight	1
8	Corporate Authors	11
9	Anonymous	9
	Total	728

The trends in the chronological development of literature are presented in Table 3. The number of publications in a year ranged 0-48 with the years 1997 and 2000 recording the maximum publications (48). The International Galliformes Symposium were held during 1997 (Malaysia), and 2000 (Nepal). About 438 references (60%) on Galliformes were published during the period 1991-2007.

Table 3 : Chronological Development of literature

S.No.	Period	No. of References
1	1848-1900	29
2	1901-1910	14
3	1911-1920	26
4	1921-1930	11
5	1931-1940	20
6	1941-1950	12
7	1951-1960	12
8	1961-1970	31
9	1971-1980	48
10	1981-1990	87
11	1991-2000	295
12	2001-2007	143
	Total	728

For the convenience of the user, this bibliography is also available in database form at the Library and Documentation Centre, Wildlife Institute of India. This bibliography shall be provided in printed form as well as through machine readable database to users. This database will be useful and act as a ready reference to both professional and amateur wildlife ecologists, and protected area managers, interested in the Galliformes of India. Though we tried our level best to consult as much literature as possible, we still believe that this database may be incomplete. A few reference numbers have been left blank (indicated by --*) as the study area limits within India has not been mentioned. While all possible efforts have been made to cite the references as accurately as possible, it is probable that some mistakes have remained, largely owing to the compilation of the majority of references from secondary sources. We would be grateful if such mistakes are brought to our notice for correction and continuous updation of this database.



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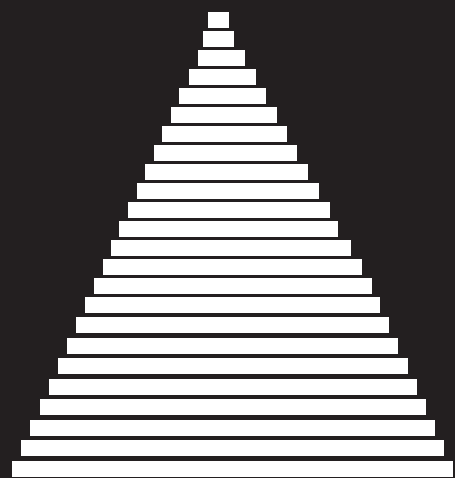
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